Higher Education for Development (HED)
and
U.S. Agency for International Development (USAID)

""*Sustainable water resources: Capacity Building in Education, Research and Outreach*"

Addis Ababa University and University of Connecticut Partnership

December 15, 2010-September 29, 2015

USAID/Associate Award
Cooperative Agreement # AEG-A-00-05-00007-00
Associate Cooperative Agreement # AID-663-LA-11-00001

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American Council on Education (ACE) | American Association of Community Colleges (AACC) | American Association of State Colleges and Universities (AASCU) | Association of American Universities (AAU) | National Association of Independent Colleges and Universities (NAICU) | Association of Public and Land-Grant Universities (APLU)

PARTNERSHIP INFORMATION

Lead Partner Institutions: University of Connecticut and Addis Ababa University
Secondary Partner Institutions: Mekelle University, Arbaminch University, Hawassa University, and Bahir Dar University
Region, Country: Sub-Saharan Africa
Performance Period: December 15, 2010-September 29, 2015
Funding Level: Associate Award: $2,874,806 and Subaward: $2,456,285
Proposed Cost Share: $1,264,906

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List of Acronyms

AAU	Addis Ababa University
AAiT	Addis Ababa Institute of Technology
ACE	American Council on Education
EIWR	Ethiopian Institute of Water Resources
FY	Fiscal Year
HED	Higher Education for Development
HICD	Human and Institutional Capacity Development
IWMI	International Water Management Institute
M&E	Monitoring and Evaluation
MIE	Mesfin Industrial Engineering
MoU	Memorandum of Understanding
MoWIE	Ministry of Water, Irrigation and Energy
MSc	Master of Science
NGO	Non-Governmental Organization
NCAR	National Center for Atmospheric Research
PhD	Doctorate degree
PRIME	Partnership Results & Information Management Engine
PTA	Parent Teacher Associations
Q1-Q2	Quarter one and Quarter two
Q3-Q4	Quarter three and Quarter four
SNNRS	Southern Nations and Nationalities Regional State
UCLA	University of California, Los Angeles
UCONN	University of Connecticut
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USG	United States Government
UN	United Nations
WASH	Water, Sanitation, and Hygiene
W&H	Water and Health
WHO	World Health Organization
WREM	Water Resources Engineering and Management

1. Executive Summary

In December 2010, the American Council on Education (ACE) and USAID/Ethiopia signed an Associate Award Agreement, providing funding for a partnership between Addis Ababa University (AAU) and University of Connecticut (UCONN) entitled "Sustainable Water Resources: Capacity Building in Education, Research and Outreach." ACE/Office of Higher Education for Development (HED) executed a subaward agreement with the University of Connecticut effective January 14, 2011. USAID obligated $2,874,806 to support partnership activities, focusing initially on Water Resources Engineering and Management (WREM) and after 2012 on Water, Sanitation and Health (WASH) programs. Partners agreed to provide $1,264,906 in cost share and matching resources. This report covers the period from January 14, 2011-June 30, 2015.

Partnership Objectives

The objectives of the partnership were to:

1. Increase the ability of tertiary educational institutions to offer relevant and high quality education in water and health
2. Enhance higher education institutions' ability to conduct quality research in Water and Health
3. Improve outreach and community engagement
4. Develop capacity of the Ethiopian Institute of Water Resources (EIWR).

The partners aligned their objectives with the higher education expansion and reform strategies of the Ministry of Education and Water Sector of the Ministry of Water Resources and Development, and with health-sector development strategies of the Ministry of Health. Partners collaborated and promoted synergies with U.S. government (USG) initiatives in Ethiopia. The partnership activities also aligned with USAID/Ethiopia's Sustainable Water Resources Management programs; Water, Sanitation, and Hygiene (WASH); Climate Change Adaptation and USAID's overall Human and Institutional Capacity Development (HICD) strategies.

Goals and Vision

The vision of the partnership was to establish a long-term, mutually beneficial academic partnership between the U.S. and Ethiopian institutions to train the next generation of leaders to develop and manage Ethiopia's water resources in a sustainable and productive manner.

The partner universities collaborated to prepare professionals capable of undertaking relevant research and to address development challenges through demand-driven and problem-solving research and community engagement. Community engagement focused on providing access to clean water and on educating community members about sanitary health practices. Women, in particular, were encouraged to participate in all community activities.

During the four years of the award, partners:

- Established the Ethiopian Institute of Water Resources (EIWR), which is Ethiopia's first institute dedicated to addressing critical water-related challenges at a national and regional level.
- Created four new graduate-level programs and courses in water-related areas; MSc and Ph.D. in Water Resources Engineering & Management (WREM) and MSc and Ph.D. in Water and Health (W&H).
- Supported 38 students towards completion of their graduate degrees, including two Ph.D. students in the WREM program.
- Collaborated with over 80 stakeholders at the local, national, regional and global levels on research and outreach.
- Reached 16,095 community members through EIWR's outreach activities, which involved building innovative latrines, teaching the importance of hand-washing, providing an experiential learning experience for undergraduates, and guiding a rural community on how to install a de-fluoridation vessel.
- Conducted 32 short-term trainings benefitting 596 individuals between 2011-2015. Trainings included research methodology workshops, internships, professional trainings, courses and seminars.
- Contributed to the field of research through conference presentations and publications. The MSc/Ph.D. curricula are rigorous and require students to publish and share research, which sets it apart from other doctoral programs.
- Submitted eight proposals for financial support and were awarded three of them, which contributes to raising awareness about their institute through research and community engagement.
- Enhanced the facilities of EIWR by improving research laboratories and by purchasing specialized equipment like the gas analyzer.

This partnership succeeded in achieving their objectives, but it was a challenging road to success. Partners realized that developing a highly functioning, self-supporting, academic research institute takes time and patience. The navigation of institutional standards, procedures, relationships, protocols, and facilities required focused teamwork from everyone involved. Partners are proud of their perseverance, but realize that constant refinement and strengthening of the institute is required to continue to meet Ethiopia's complex needs around water management and health.

This report is based on progress reports submitted by the University of Connecticut and AAU/EIWR partners in HED's Partnership Results & Information Management Engine (PRIME) for each semi-annual/annual reporting period between 2011-2015.

2. Partnership Overview

Based on Ethiopia's critical need for sustainably managed water systems and resources and the need for faculty to train future generations of water managers and researchers, Addis Ababa University and the University of Connecticut (AAU-UCONN) formed a partnership to establish a new institute for water resources management. The purpose was to develop graduate programs (both Master's and Ph.D.) to train students to conduct research related to managing water resources, and to engage communities in improving water access and systems.

During the first two years of the award period, the partners dedicated most of their efforts towards the creation of the Ethiopian Institute of Water Resources (EIWR), which is now a recognized entity within Addis Ababa University and is responsible for four academic programs at the graduate level. The EIWR was the center of activity for the partners and all innovative strategies and collaboration funneled through the institute.

The AAU-UCONN partnership in its Phase I program, built capacity in graduate-level education, research, outreach and institutional development in sustainable water resources management that addressed one of the most critical development priorities of Ethiopia: water resources management. Partners established EIWR to strengthen the capacity of collaborating higher education institutions in Ethiopia in areas related to food security, cleaner energy production, improved human and environmental health, and advancement of educational opportunities.

In its Phase II program, the partnership focused on Water, Sanitation and Health (WASH) activities. The partners designed two tracks within the "Water and Health" steam entitled '*Water & Wastewater Treatment*' and '*Water & Public Health'*. Partners also organized short-term and tailored training programs for faculty, staff and community members around these areas.

The "Water and Health" graduate program provided a unique opportunity to strengthen collaboration among the US partner institutions and the universities of Addis Ababa, Mekelle, Hawassa, Arba Minch, and Bahir Dar to design a relevant curriculum.

A full list of partnership achievements during both phases of implementation is included in the Partnership Results and Performance section below.

During the period of performance of the partnership award, HED/ACE worked closely with UCONN and AAU partners toward quality and timely submissions of quarterly financial expenditure reports and implementation progress reports. HED held monthly conference calls with UCONN, AAU, and USAID/Ethiopia, which were crucial in addressing challenges and facilitating close follow-up and support in implementation. Continuous engagement and communication among HED, UCONN and AAU partners, as well as with USAID/Ethiopia provided guidance to address issues, such as revising monitoring and evaluation plans, improving budget utilization and monitoring implementation progress effectively.

3. Partnership Results and Performance

This section examines the partnership's objectives, and presents data supporting progress toward achievement of the partnership's targets. During the final two years of the partnership, HED utilized results-based management principles and a management information system (Partnership Results and Information Management Engine, or PRIME) to manage the performance of higher education partnerships. The HED reporting system, therefore, became more systematized and robust, in the second year of the partnership performance period, with data verification and substantiation of documents supporting data. The partnership's M&E plan and reporting in FY11 was not systematized affecting the quality of data and reports. In addition, during the first half of the performance period, the partnership was affected by several changes in USAID standard indicators and their definitions.

Disaggregated data for all activities was not available. Furthermore, for several activities under outreach and short-term training, individuals may have been counted more than once.

Achievements and Implementation Progress

Objective 1: Increased ability of tertiary educational institutions to offer relevant and high quality education in water and health

Number of new academic certificates and/or degree programs

The UCONN/AAU Partnership developed four graduate degree programs during the life of the partnership. The programs were strengthened by feedback from a wide range of stakeholders including local and international faculty, local NGO's (e.g. WHO and UNICEF), and government representatives. All courses were designed with local interests in mind and they incorporated elements of experiential learning. These graduate programs will leave a legacy at AAU and in Ethiopia as they help to produce skilled faculty and professionals in disciplines related to water management and health.

1. MSc in Water Resources Engineering Management (WREM)
2. Ph.D. in Water Resources Engineering Management (WREM)
3. MSc in Water and Health (W&H)
    a. Track A: Water and Public Health
    b. Track B: Water and Wastewater Treatment
4. Ph.D. in Water and Health (W&H)
    a. Track A: Water and Public Health
    b. Track B: Water and Wastewater Treatment

Percent of curricula newly developed and/or revised with private and/or public sector employers' input or on the basis of market research

The partnership invested considerable efforts and resources in revising and updating program curricula with stakeholder input. **One hundred percent of the program curricula were developed and/or revised with insight and advice from public and private sector employees**. Through a series of workshops and consultation meetings, the curricula were reviewed and

enriched by stakeholders, including NGOs, federal and regional government organizations, academia, and the private sector. Stakeholders involved in the curricula review process included College of Natural and Computational Sciences (AAU), Addis Ababa Institute of Technology (AAiT), College of Public Health (AAU), UNICEF, WHO, Ministry of Water and Energy, Addis Ababa Municipality, and regional universities. They contributed to the design and development of course content. Two external evaluators (Emory and Oklahoma universities) and two internal evaluators (School of Public Health, AAU and Addis Ababa Institute of Technology, AAU) reviewed and evaluated the curriculum. The curriculum was finalized and approved by the AAU senate, which is the highest level of review.

Number of host-country individuals (faculty and/or teaching staff, students, and administrative / other staff) affiliated with the host-country institution who completed long-term training programs for qualifications strengthening

One of the partnership's greatest achievements was supporting graduate students towards completion of their degrees. **Thirty-eight students, many of whom were faculty at local institutions, completed graduate degrees. Two individuals completed doctorate degrees, Elisa Tedla and Belete Berhanu.** Elias defended his dissertation entitled, "Multi reservoir Operation Optimization under different Climatic Scenarios to Maximize Energy Production Efficiency," and Belete defended his dissertation entitled, "Development of Rainfall-Runoff Method and Watershed Planning Tool Based on the Hydrological Regimes of Ethiopia." Four additional doctoral students defended their proposals and are expected to graduate at the end of 2015. The completion of these degrees marks a significant milestone for the partnership and Addis Ababa University. The programs are institutionalized into the university and enrollment is expected to grow over the coming years.

Table 1
Number of host-country individuals who completed long-term training programs.

Master's Degree Program	**Target**	**Number of Graduates**		
		Female	**Male**	**Total**
WREM	68	1	13	14
W&H		13	9	22
Total MSc		**14**	**22**	**36**
Doctorate Degree Program				
WREM		0	2	2
W&H		0	0	0
Total Ph.D.		**0**	**2**	**2**
Grand Total		**14**	**24**	**38**

Number of new or improved policies and/or procedures that supported increased access of underserved and/or disadvantaged groups to tertiary education programs

Early on in the partnership (2012), the partners developed a student-selection policy to ensure opportunities for enrollment were available for underserved populations. **The first stipulation of the policy ensured that 50% of all admitted students were female and the second portion ensured that 10% came from underserved regions** (Afar, Benshangul, Somali, and

Gambella). The adoption of the policy had particular impact on the WASH program since it was in development at the time. Partners adhered to this policy. EIWR admitted 40 underserved students (including 33 females) out of 117 students (34%) between 2011 and 2015. For the WASH programs it was higher - 46% (26 out of 57). Four males from the underserved regions of Afar, Benshangul, Somali, and Gambella were admitted to the program. The percentage of underserved students enrolled was higher when the students were supported by the USAID project.

Objective 2: Enhanced higher education institutions ability to conduct quality research in Water and Health

Short Term Training

The partnership conducted 32 short-term trainings benefitting 596 individuals between 2011-2015. Trainings included research methodology workshops, internships, professional trainings, courses and seminars. Students, faculty, staff, and stakeholders participated in these activities to build capacity around water resource management and health. UCONN, AAU, partner universities, and international faculties implemented the short-term trainings through joint efforts. Table 2 lists all activities between FY11 to FY15.

Table 2
Short-term Trainings

		Number of Participants		
FY	Name (Training Title/Description)	Female	Male	Total
FY11				
	Undergraduate students from partner universities received training in field research techniques on community water-related problems.	15	31	46
FY11 Total		**15**	**31**	**46**
FY12				
	Governance training in Boston; "World Water Week" conference in Sweden;	9	33	42
FY12 Total		**9**	**33**	**42**
FY13				
	Short course on hydro-geophysics methods	2	14	16
Total FY13		**2**	**14**	**16**
FY14				
	Internships/Exchanges at US Universities	0	2	2
	Human Resource Training	2	1	3
	Training on Building Adaptive Water Resource Management in Ethiopia	2	20	22
	Seminars and Trainings	42	64	106
	Summer Undergraduate Community Outreach/Research training	32	64	96

	Research training on "Water, food and livelihood security in northern Ethiopia" and "Maximization of Sesame & Cotton Productivity in Humera and Tsegede areas in Ethiopia"	4	14	18
	Baseline Data Collection Training at Hawassa University	2	8	10
FY14 Total		**84**	**173**	**257**
FY15				
	Eddy Covariance Gas Analyzer Measuring Instrument	2	8	10
	Nutrient Cycling and Lab Techniques	1	10	11
	Advanced Wastewater Treatment	2	5	7
	Introducing SPSS as data analysis tool	2	6	8
	Data Overload: How to deal with Multi-Dimensional Data Sets	1	9	10
	Introducing STATA as data analysis tool	2	6	8
	Concepts, Techniques and Models of Computer Programming	0	9	9
	Water Resource Management and Global Politics	0	9	9
	Introducing analysis of repeated continuous and binary outcome data	2	6	8
	C++ Object Oriented Concepts	1	9	10
	The use of remote sensing to support hydrologic applications and water management with a selection of case studies	2	18	20
	Hydro climate modeling: a tool vital for meeting water resources challenges	1	19	20
	Systems Approaches to Study Climate, Water and Diarrhea	4	9	13
	Training of 4 EIWR students abroad	2	2	4
	Project Management Training	5	7	12
	Seminar on Interventions to Control Contamination of Surface Water Resources	2	11	13
	Seminar on Routes and Mechanisms of Transmission of Water Borne Bacterial Infections	2	11	13
	Seminar on Water related Viral infections and Diseases	2	10	12
	Seminar on Impact of Water Resource Development on Schistosomiasis	2	10	12
	Seminar on Role of WASH in the Prevention and Control of Soil Transmitted HelminthsIASIS and Schistosomiasis	2	11	13
		2	10	12

	Seminar Potential Threat of Submicroscopic Plasmodium Falciparum Infection to Malaria Control Communications Workshop	1	0	1
Total FY15		**40**	**195**	**235**
FY11-FY15 Total		**150**	**446**	**596**

Research-Joint

The Partnership established a strong foundation in research methodology that will contribute to the partnership's sustainability. UCONN/EIWR selected research topics that were relevant to local needs and they engaged community members in the research process. Summaries of several major research initiatives are included below.

1. **Magnesium Oxide as an Alternative to Activated Alumina for Defluoridation:** This research activity explored the effectiveness and efficiency of Magnesium Oxide as an alternative to activated alumina for defluoridation. This research complemented EIWR's work in Kori Afar, where EIWR has been experimenting with using activated alumina to de-fluoridate water on a community scale. The UCONN students worked with EIWR graduate students to understand the parameters for the study.

2. **Malaria Research Project:** A multi-institutional research team including researchers from EIWR, School of Engineering at UCONN, the Dept. of Zoological sciences at AAU, and the Tropical and Infectious Diseases Research Center at Jimma University, established a research site in the Ghibe Basin. The main objective of the proposed work was to establish a malaria field research site that will generate comprehensive field data to investigate the dynamics of climatic, ecological, anthropogenic factors as drivers of malaria transmission in low-elevation and higher-elevation areas where the proliferation of water resource development activities (dams, irrigation canals, diversions, etc.) may aggravate the extent and intensity of malaria transmission.

3. **Hydrology Research on Freshwater and Erosion:** A team of researchers from UCONN and EIWR established a new research site in the Melka-Kunture watershed and strengthened an existing site in the Andit Tid watershed. The site was designed to continuously collect data on the dynamic water balance components (rainfall, soil moisture, and runoff). In addition, data on static catchment properties (infiltration, saturated hydraulic conductivity, soil physical and chemical properties) were collected using hand-held instruments.

4. **Research on Clay Filtration Pots for Removing Pathogens from Drinking Water:** The Partnership is exploring the possibility of introducing clay filters for water purification into communities in Ethiopia. Dr. Jon Mellor from UCONN, discovered a small vendor who is producing filters just outside Addis Ababa. Now, the University of Connecticut and EIWR are testing some of the filters to see how effectively and efficiently they are at removing bacteria. These household filters have the potential for removing the harmful pathogens responsible for 800,000 deaths each year of children

around the world. If researchers discover that these locally-manufactured filters perform well in the lab, EIWR staff will field-test in Ethiopia in communities that need water treatment.

Research outputs/products developed and presented

Student development was central to research objectives and products. In order to establish strong graduate programs in technical disciplines, partners had to invest in research laboratories and student research support. The following list summarizes major research outputs produced over the life of the partnership.

- Two research labs constructed and continually enhanced.
    - The Hydro-informatics lab located at EIWR's Akaki campus was developed to test hydrological software and models.
    - The Hydro-meteorological field laboratory was established to generate reliable information on rainfall characteristics over the complex terrain of the Blue Nile River Basin.
- 81 student research projects were developed with joint institutional support.
- 28 Ph.D. students are at various stages of completing their research and publishing their results.
- 8 policy briefs were developed.
    - Reflection on Sediment Retention and Valuation Process
    - Physio-chemical Water Quality Analysis of Water Supply Reservoirs in Addis Ababa
    - Defluoridation of Ethiopian Ground Water using Magnesium Oxide
    - School WASH project in selected Ethiopian primary schools
    - Need Based Health Extension Work Training on Water, Sanitation, Hygiene: Evidence from Community Outreach
    - Development and formalization of a sustainable hand pump model in Ethiopia.
    - Establishment of pilot agricultural research and testing sites to support local farmers through improved irrigation and water productivity practices.
    - Development of multi-stakeholder communication and planning platform; including the bureaus of Agriculture, Water Resources, Agricultural Marketing promotion Agency, Agricultural Research Institute, NGOs, private traders etc. to ensure improved water productivity and livelihood in the existing schemes.

Objective 3: Improved outreach and community engagement

Outreach/Extension

EIWR worked with 24 different communities on water and sanitation challenges through four community outreach activities.

1. *Innovative Latrines*:

EIWR installed two school latrines and water supply systems in partnership with Hawassa University at two schools, Bushulo and Chef Koti Jebesa, located in rural villages in the vicinity of Hawassa in Southern Nations and Nationalities Regional State (SNNRS). The schools were

selected because they lacked sufficient latrines and water supply systems, mainly for girls. Previous facilities had broken pipes, damaged drinking water fountains and poorly maintained hand-washing basins. The new girls' latrine also makes provisions for disabled female students and staff. Hand-washing basins and drinking water fountains were also constructed outside the latrines in an accessible location for students and staff.

Table 3
Number of water points and model latrines built.

Target	Total	
1	Model Latrines	2
	Water points	2
	Total	**4**

The technology for the innovative latrine was adapted from a UNICEF design that was adopted by the Ministry of Health and the Ministry of Education. EIWR adapted the design to fit the needs of girls and female staff.

At the handover ceremony, a sustainability plan was signed by the contactor, EIWR, Hawassa University and the directors of the schools. Data indicates that 40% of latrines in the region aren't being used because of lack of education; therefore, the co-signees hope to engage local government, civil society, and parent teacher associations (PTA) in managing the water systems and promoting WASH practices. A WASH Club was established at one of the schools.

Water points and model latrines: Partners reported that 3,318 households (Table 4) near the two schools in Hawassa have access to improved drinking water sources and enhanced sanitation facilities. The schools' facilities are available to the students' and teachers' families as well as members of the communities.

Table 4
Number of households that have access to improved drinking water sources.

Outreach Activity	Target		Total reached		
			Female	**Male**	**Total**
Innovative Latrine Construction at two schools in Hawassa	4,000	Chefe Koti School Teachers	16	21	37
		Chefe Koti School Students	792	612	1,404
		Bushulo Teachers	24	23	47
		Bushulo Students	965	865	1,830
Total			**1,797**	**1,521**	**3,318**

Improved water and sanitation services: In addition to the above outreach activities, partners improved water and sanitation services in 19 communities (Table 5). Two communities received new water and sanitation facilities in primary schools in South Nation, Nationalities and People Regional State capital city Hawassa. Seventeen kebeles from four different regions (Tigray,

Amhara, Oromia and Southern Nations and Nationalities People) were reached during the summer outreach project that promoted hand washing and hygienic practices.

Table 5 Number of communities receiving improved water and sanitation services	
Target	**Total**
3	**19**

2. Summer Outreach Program:

During the summer of 2014, EIWR partner universities (Addis Ababa, Arbaminch, Bahir Dar, Hawassa and Mekelle) engaged 96 undergraduate students in an outreach project that promoted hygiene through hand washing practices. A total of 12,695 are estimated to have benefitted from the summer outreach program (Table 6). The universities selected 6 woredas and 17 kebeles near the five universities to conduct the outreach. The students spent 40 days in the selected communities and collected WASH baseline information. They also implemented a hygiene promotion activity focusing on hand-washing to communities residing in the selected areas. Students promoted hygiene, specifically hand-washing to households through house-to-house visits and community gatherings. They distributed hygiene promotion materials and led demonstrations.

Table 6 Number of households that are aware of critical moments of hand-washing.	
Target	**Total reached**
500	12,695

In addition to the outreach component of the project, students collected data on WASH practices, distributed surveys to establish a baseline for basic demographic and behavioral information, and also led focus group discussions and conducted key informant interviews. Finally, the students observed the condition of the latrines of households they visited and made a sanitary inspection. The data was compiled and presented to officials from each kebele's health sector and to community members. The findings revealed critical gaps and possible solutions to improve WASH education and facilities in the communities.

3. Training for Health Extension Workers:

The Ethiopian Institute of Water Resources (EIWR) held a three-day training workshops for health extension workers from four regions on how to engage and train communities around potable water, sanitation and hygiene practices. The workshops were held in the same communities where EIWR held its summer community engagement program for undergraduate students the previous summer. EIWR staff, representatives from partner universities including Addis Ababa University, Arbaminch University, Bahirdar University, Hawassa University, Mekelle University, and regional health bureaus worked together to organize the workshops and to recruit 100 health extension agents (3 male and 97 female) from the five sites.

Table 7 Health Workers Training.				
Outreach Activity	**Target**	**Total reached**		
		Female	**Male**	**Total**
Extension Agent Training	100	97	3	100

The training focused on water supply, sanitation, hygiene promotion, and empowering communities to bring about change. The instructors modified each workshop to address the unique problems facing each region. Participants reported that the training was valuable because it helped to fill critical gaps in knowledge, it emphasized the importance of understanding problems from the community's perspective, and it helped to explain the relationship between water supply and health. They also said that the training helped them to better understand their responsibilities and how important it was to work with other stakeholders.

4. *De-fluoridation Project at Kori in the Afar region:*

One of EIWR's main outreach activities was installing a de-fluoridation vessel at Kori, Afar. After many delays, the activated alumina finally arrived, and now, the community needs to build a platform for holding the vessel. Because the partnership and USAID felt that it was critical to do everything possible to fully install the innovative de-fluoridation vessel in Kori, Afar, considerable efforts were made to find ways to facilitate the activity. The major roadblock to completing the project was that the local administration was not able to find a contractor to complete construction of the platform and reservoir required for setting up the vessels. Everything else was in place including the vessels, the activated alumina, the training manuals, and the testing protocol; however, the vessel still needs to be secured to a platform.

Despite the challenges observed in meeting the set deadlines, both parties worked hard to complete all other aspects of the project.

EIWR hired consultants to complete the testing protocol, to create an operations and training manuals, to prepare site surveys, and to hire alternative contractors. Finally, a one-day training was delivered to 10 field level water managers in Semera on how to install and maintain the vessel.

Objective 4: Developed capacity of the (EIWR) Institute

Since its establishment in 2012, EIWR has become a fully integrated institute within Addis Ababa University. EIWR established an independent cost center with a budget of 3.4m Birr (about $170,000) for the 2015/16 fiscal year. Demonstrating its commitment to the mission of the Institute, AAU has provided support to EIWR to hire staff and provide facilities for housing students, teaching courses, and conduct program administration. EIWR will enroll new students this fall into the W&H and WREM programs, which are now part of AAU's standard offerings. One of EIWR's greatest challenges will be to hire faculty to deliver courses and to recruit staff to administer the academic programs.

AAU is close to completing a long-term strategic plan for the entire university. When this is complete, EIWR will develop their own strategic plan, which will consider the goals and priorities outlined in the university plan. This plan will help EIWR to develop a strategy for seeking additional funding for program development, innovative research, graduate student fellowships and internships, and research lab development. The institute will need to search for funding from a variety of sources including AAU, ministries and other federal sources, corporations and foundations, as well as through collaborations with UCONN and other foreign universities. EIWR will also develop a human resources plan as part of its strategic plan.

AAU has designated funds out of its capital budget for the design and construction of new buildings and laboratory facilities for EIWR on the outskirts of Addis Ababa. The design will be completed within half a year and construction is expected to start in early 2016.

Proposals Developed

Awarded:

1. EIWR collaborated with the School of Chemical and Bio Engineering (Addis Ababa Institute of Technology) and the Department of Environmental Health from Jimma University and won a 221,200.00 ETB ($10,750 USD) grant from the Ethiopian Ministry of Water, Irrigation and Energy for the research project "Development of Clay Based De-fluoridation Technology to Mitigate Fluorosis in the Ethiopian Rift Valley Communities". The main objectives of this project are to identify the most efficient clay types and develop household level fluoride removal technology.
2. EIWR in collaboration with the School of Chemical and Bio Engineering (Addis Ababa Institute of Technology), the Department of Environmental Health from Jimma University, the Ethiopian Public Health Research Institute (Ethiopian Ministry of Health) and the Ethiopian Ministry of Water, Irrigation and Energy were awarded funding based on a proposal entitled, "Development of Defluoridation Technology from Local Materials to Mitigate Fluorosis in the Ethiopian Rift Valley Communities," to the Ethiopian Ministry of Science and Technology with an estimated budget of 3.2 million ETB.
3. UCONN was awarded a grant for the NSF PIRE/PEER program entitled, "Taming Water in Ethiopia: An Interdisciplinary Approach to Improve Human Security in a Water-Dependent Emerging Region." EIWR will be the hub of the project's research activities in Ethiopia. EIWR will now submit an application for the PEER program.

Not awarded or Pending:

1. EIWR submitted a proposal to the Global Resilience Challenge entitled "Global Resiliency Challenge for Building Resilience to Acute Shocks in the Horn of Africa", led by Dr. Daniel Weiner, Vice Provost for Global Affairs, Office of Global Affairs, University of Connecticut. The proposal focused on the need for research and action on water resource governance issues in the Blue Nile Basin.
2. A $1,150,283.75 proposal for funding to UNICEF Ethiopia - The ONE WASH PLUS Program. The specific objectives of the project were: (1) developing and implementing a comprehensive package for urban Hygiene and Sanitation in Program areas, Curriculum Development and Implementation of an urban water and sanitation capacity building

package, (2) strengthening and enhancing the participation of Civil Society Organizations (CSOs) in the implementation of the national WASH program.

3. A concept note for "Improving Food Security among Small-Holder Farmers in Drought Prone Areas of Ethiopia using Inter-cropping and improved Agricultural Water Management" was submitted in response to call for papers from Innovative fund for Improving Food Security in Ethiopia.
4. Partners submitted a White Paper to the GE Foundation entitled, "Clean Water for Health."
5. EIWR in collaboration with Technical University of Dresden, UBP (Blaise Pascal University), UT, University of Dodoma, and University of Logos submitted a research proposal entitled "Adaptive and Scalable Water Quality Monitoring System" to European Union (EU)with an estimated budget of 2.1 million.

New linkages with NGOs, networks and stakeholders

Partners collaborated with over 80 organizations during the life of the partnership. The partnership encouraged collaborative engagement by 1) implementing innovative research and outreach projects with partner universities and local communities; 2) participating in technical working groups to stay at the forefront of advances in the WASH sector and to explore ways to share resources, support students, search for grant funding and to identify research questions; and by staying informed about water technology and implementation challenges in the WASH sector 3) integrating community engagement within outreach projects; and 4) inviting representatives of NGO's, private industry, government, and other educational institutions to engage with students, to attend workshops and research presentations, to offer seminars, and to advise students.

Table 8
Collaborating Stakeholders 2011-2015

Name	Type	Description
Ministry of Water and Energy Organization, Hamlin Fistula Ethiopia, Nile Basin Initiative, Amhara Design and Supervision Works Enterprise, University of Bern, Switzerland, Afar Water Resource Bureau, USAID/Ethiopia, Metahara Sugar Factory, National Meteorological Agency, Wonji Shoa Sugar Factory, Ethiopian Electric Power corporation, Environmental Protection Authority, Geological Survey of Ethiopia, Ministry of Agriculture, UNEP Engineering Capacity Building Program, South Design & construction supervision Enterprise, Germany Embassy, IBM South Africa,	Government, NGO, private sector, educational institutions	54 organizations attended the launch of EIWR in 2011.

SNV/Netherlands Development Organization, Benishangul Gumuz, Ministry of Water/Mine and Energy Resource Development Bureau, Korea Environment Institute, Prime Minister Office International Water Management Institute, Tigray Water Resource Bureau, Amhara Region Bureau of Water Resource, WHO Administration for Refugee - Returnee Affairs (ARRA), Ministry of Education, UNESCO – IHE, USAID/Ethiopia UNICEF, Water works construction enterprise, UN-WFP, Addis Ababa University, Dilla University, Korea Environment Institute, OMMDSE, Tigray Water Works Study Design a Super vision Enterprise, Alabama A&M University, University of Connecticut, SNNPR Water, Metaferia Consulting Engineers Plc., Water Aid, Ethiopian Institute of Agricultural Research Center, Relief Society for Tigrai (REST), Higher Education for Development, CPPI, Helvetas, Arba Minch University, Mekelle University, Bahir Dar University, Hawassa University, Benishangul Gumuz Water Works Enterprise		
Heineken Foundation	Private Sector	Four meetings were conducted with the Heineken Foundation to introduce EIWR to the Foundation, mainly to identify common concerns in the area of water and livelihood associated with the Heineken project areas. Potential areas identified included: undergraduate summer outreach engagement and the establishment of special community projects involving Heineken-sponsored students in the Water and Health track.
Hilton Foundation	NGO	EIWR made efforts to work collaboratively with the Hilton Foundation. Presentations highlighted EIWR's efforts, impacts, and possible areas of collaboration. The Foundation's senior management as well as various key NGOs, such as World Vision, agreed to further discuss potential partnership issues and to design concerted interventions focused on WASH and food security issues.

UNICEF	NGO	UNICEF participated in the curriculum development workshop for the Water and Health track. EIWR staff had multiple consultation meetings with UNICEF representative, Dr. Samuel Godfrey, Chief of Water and Environmental Health Program. During these meetings, they identified partnership niches on joint implementation of model latrines and innovative water supply technologies; scheduled a briefing meeting to explore partnership niches and review a draft MoU; and arranged for a seminar given by Dr. Samuel Godfrey for the students at EIWR. UNICEF provided financial support to the Kori Water Supply project (through Afar BoWR); and the construction of water supply structures. They provided guidance and research support to some EIWR students on the WASH sector. EIWR staff participated in various local and international urban WASH workshops.
World Health Organization	NGO	WHO participated in the curriculum development workshop for the Water and Health Track
National Meteorology Agency, Oromia Water Works Design and Supervision Enterprise, and Addis Ababa Water & Sewerage Authority	Government	Actively participated as trainers for the high school water science training.
Water and Land Resource Center	Educational institution	EIWR, and the Water and Land Resource Center signed an MoU on accessing a database from the Center's hydro-sedimentology observatory stations and learning watershed
Swedish Environmental Institute (SEI)	NGO	Conducted impact assessment on adaptation in Lake Tana. Led by Prof Louise Karlberg (louise.karlberg@sei-international.org), Dr Solomon GYohanes, Dr Bewket Woldeamlak and Dr Tena Alamirew.
School of Public Health, College of Health Science	AAU	Delivered MSc and PhD course. Dr Ababi Zergaw delivered a MSC and PhD course WaHe 6041 Water & Socio-economics of Health in April 2013.
University College Dublin	Educational Institution	Dr Mary. Kelly-Quinn (mary.kelly-quinn@ucd.ie) Senior Lecturer at School of Biology & Environment Science, Centre Belfield Dublin, University College Dublin, Ireland, delivered a MSc and PhD course on Environmental Pollutant WaHe 6152 in 24 June -12 July 2013. Dr Kelly was also involved in advising a W&H PhD student in research on urban agriculture and water pollution impact.
Ethiopian Commission on Large Dam (ETCOLD) / Ministry of Water & Energy	Government	EIWR staff, Dr Yilma Seleshi, who is a member of ETCOLD attended Hydro 2013 conference in Addis Ababa between 16 and 18th April 2013 held at African Hall with more than 600 participants from 67 countries
Regional Environmental Office for East Africa	Government	EIWR had multiple consultation meetings with the Regional Environmental Officer for East Africa, located at the Embassy of the United States at Addis Ababa with, Dr. Elizabeth S Wharton, Dr. Edwin Brown and Dr. Teka to discuss environmental issues in Eastern Africa, and ways to cooperate in capacity building to parliamentarians.
Office of Education, Hawassa Zuria Wereda	Government	EIWR staff had multiple consultation meetings with the Office of Education in the SNNRS, brainstorming and planning meetings with the representative. Agreement was reached to jointly engage in identifying partnership niches, to training health extension agents, and creating an open defecation free community. Furthermore, the relationship facilitated and endorsed the contract agreement for

		implementing 2 model latrines in 2 pilot primary schools.
Adaptive Water Resources Management in Ethiopia (AWRME) Steering Committee	Government	EIWR staff had multiple consultation meetings and participated in the AWRME project steering committee meeting, which engaged key partners, including MoWIE, ODI and IWMI.
Ethiopian Panel of Climate Change (EPCC)	Government	EIWR staff participated in the first National Operational EPCC workshop, organized by National Academy of Sciences/ NAS. EIWR is identified as one of the lead organizations with expertise in the areas of climate water, irrigation and energy
Mesfin Industrial Engineering (MIE)	Private Sector	EIWR staff, AAiT staff, and AAU College of Natural Science staff worked with Mesfin Industrial Engineering to evaluate the technology for the de-fluoridation vessel for Kori and prepare the related design documents for activated alumina based fluoride removal facility. A draft MoU was shared among the stakeholders to catalyze the partnership between MIE and EIWR_AAU for further development of water technologies.
Tesfa Industrial Engineering	Private Sector	This engineering firm worked with EIWR in designing and building the vessel for de-fluoridating water in Kori, Afar.
National Academy of Science (NAS)	Educational Institution	The National Academy of Science (NAS), acknowledged the dedication and meaningful contribution by EIWR staff, Dr Yilma Seleshi and Tesfay Alemseged during the workshop to launch the EPCC February, 2014. NAS invited EIWR staff member Tesfay Alemseged to work in the national water, irrigation and energy working group.
Bahir Dar University	Educational Institution	Bahir Dar University was one of the five partner universities that worked closely with EIWR to plan and implement a summer community outreach activity for undergraduate students from each of the five participating universities.
Arbaminch University	Educational Institution	Arbaminch University was one of the five partner universities that worked closely with EIWR to plan and implement a summer community outreach activity for undergraduate students selected from each of the five participating universities.
Hawassa University	Educational Institution	Hawassa University was one of the five partner universities that worked closely with EIWR to plan and implement a summer community outreach activity for undergraduate students selected from each of the five participating universities. In addition, Hawassa University was an implementing partner for the innovative latrine project implemented in the local area. Staff from the university assisted with the site selection, community outreach and implementation. Ten students from the University were involved in collecting baseline data from a local community.
Mekelle University	Educational Institution	Mekelle University was one of the five partner universities that worked closely with EIWR to plan and implement a summer community outreach activity for undergraduate students selected from each of the five participating universities. Additionally, Mekelle University worked with Mekonnen Gerbermical and 11 students to complete a summer undergraduate research activity with a different focus than those at the other universities—collecting data in Tigray. A multidisciplinary team of staff members from Mekelle served as mentors to supervise and assist the students in proposal preparation, fieldwork and data collection, data analysis and report writing.

Bushuullo and Koti-Chefee-Jebessa Primary Schools	Educational Institution	EIWR designed and built two innovative latrines for these two schools, with close participation and involvement of school officials. Local education and health officials were also engaged during the planning and hand-over process. When the day came to hand-over the latrine, a number of stakeholders from the area attended the event demonstrating tremendous appreciation and support for the project.
University of Arizona	Educational Institution	The NASA SERVIR Water Africa Arizona Team Project, a delegation of the University of Arizona visited EIWR. The main aim of the visit was to develop a collaborative relationship between the University of Arizona and the Ethiopian Institute of Water Resources in order to exchange knowledge and information, support research endeavors, and develop monitoring and forecasting tools.
Stakeholders at Kori Afar	Government	EIWR worked closely with stakeholders at Kori Afar to prepare for installation of the de-fluoridation vessel. The stakeholders included representatives from the Water Bureau, the Wereda Administration, Wereda Water Bureau, the Kebele Administration and local community representatives.
Regional Health Bureaus	Government	EIWR worked with regional health bureaus during the development of their training. The following bureaus provided support through recruitment and contextual guidance: Tigray Regional Health Bureau, Amhara Regional Health Bureau, Oromia Regional Health Bureau, Southern Nations Nationalities and Peoples Regional Health Bureau.
University of KwaZulu-Natal	Educational Institution	Partners worked with the faculty at University of KwaZulu-Natal to find someone with the qualifications to conduct a gas analyzer training. EIWR collaborated with Campbell Scientific in South Africa and Mike Savage from the University of KwaZulu-Natal to bring Dr. Eltayeb Sulieman Nile Babikir from Department of Agronomy, Faculty of Agriculture, University of Khartoum to EIWR to provide a training on the gas analyzer.
University of Khartoum	Educational Institution	EIWR collaborated with Campbell Scientific in South Africa and Mike Savage from the University of KwaZulu-Natal to bring Dr. Eltayeb Sulieman Nile Babikir from Department of Agronomy, Faculty of Agriculture, University of Khartoum to EIWR to provide a training on the gas analyzer.
Department of Zoological sciences of Addis Ababa University	AAU	Part of the multi-institutional research team established a malaria field research site, which will generate comprehensive field data to investigate the dynamics of climatic, ecological, anthropogenic factors as drivers of malaria transmission in low and higher elevation areas. the research sites are in the Ghibe Basin. EIWR graduate students also participated on this team.
Jimma University	Educational Institution	Participated in establishing the Malaria research sites.
University at Turbing Germany	Educational Institution	Dr. Michael Maerke, from Tuebingen Germany assisted with establishing the outdoor hydrology laboratory site.
Overseas Development Institute	NGO	EIWR served as a national hub for activities focused on Building Adaptive Water Resources Management in Ethiopia. The Institute hosted and co-organized a stakeholder workshop, prepared and delivered training courses, conducted research for a case study, and helped to draft a road map for future actions. EIWR trained 22 directors from the Ministry of Water Industry and Environment (MoWIE), and conducted stakeholder interviews, and produced a case study on adaptive water resources management. See a new report on Ethiopian Water Sector "Building Adaptive Water Resources Management in Ethiopia" produced in consultation with EIWR.

		h ttp://www.odi.org/publications/9568-building-adaptive-water-resources-management-ethiopia2)
International Water Management Association (IWMI)	NGO	IWMI provided full access to EIWR students to its compound with high speed WiFi access at the heart of the city, its exceptionally equipped resource centers/ libraries, reading rooms etc. advised PhD and MSc students, provided various seminars to EIWR students and staff as well as engaged in various professional workshops. The collaboration led to the establishment of the National Multi-stakeholder Water and Land Platform; which is chaired by WaterAid while EIWR chaired the policy support wing.
Millennium Water Alliance (MWA)	NGO	MWA guidance and research support to EIWR students focused on the WASH sector. MWA provided consistent collaboration during the three undergraduate summer outreach programs and provided support for project development. EIWR has been a permanent and reliable partner/adviser and it has been consistently engaged during quarterly meetings and strategic planning workshops. EIWR serves as a permanent member of the national Water Sector Panel of Experts.
Italian Corporation	NGO	The Italian Cooperation engaged 25 undergraduate students in identifying problems and designing rural WASH projects (improved communal latrines and water supply schemes in Arsi zone), and co-financed the student engagement along with EIWR.

3.2 Challenges

Growth and Institutionalization of EIWR: Building an institute from the ground up is challenging administratively, financially, and logistically. Establishing institutional procedures to ensure that graduate programs and other institute activities comply with the rules, regulations, and expectations of its home university Addis Ababa University (AAU)) continues to demand attention as the institute strives to become self-reliant, transparent, and sustainable. EIWR is still working to define its role and structural relationship with AAU while at the same time building collaborative relationships with multiple institutions. For example, to grow the education program, EIWR had to develop mechanisms for sharing teachers with university departments. Being anchored within another institution means adherence to policies and procedures that sometimes challenge a small staff.

Shifts in Leadership: From the beginning of the project, several changes in institute and partnership leadership resulted in the disruption of critical activities that resulted in delays. Each new leader brought a different set of skills and new opportunities; however, it was often difficult to make up for lost time.

Remote Campus Location: Having the EIWR located at the Akaki campus was a challenge for everyone. Many staff members had to travel two hours each way to work which meant fewer working hours at the office. The location also made recruiting teachers and staff a challenge. The Akaki campus did have advantages in that it was a nice location for the students and a pleasant place to work.

Financial Challenges: The financial flow to EIWR-AAU was a challenge that affected activities such as equipment purchases, hiring professional advisors, and implementing outreach activities.

- **Cost Reimbursement Model:** EIWR, like UCONN, was required by the terms of the USAID cooperative agreement to work on a cost reimbursement basis, which meant that expenses could only be reimbursed through the grant after they had occurred. Initially, this created a problem for EIWR because the Institute did not have sufficient working capital to cover expenses while awaiting reimbursement. UCONN eventually provided EIWR with a cash advance financed with matching funds, but prior to this, the project faced significant delays.
- **Procurement:** Purchasing the gas analyzer, vehicle, and activated alumina for the Kori de-fluoridation vessel posed significant challenges for the partners due to foreign exchange shortages, payment processes, customs requirements, and the location of manufacturers

Ph.D. Student Completion: The partnership originally planned for the PhD students to graduate in three years. This turned out to be an unrealistic expectation given that the program was new, teachers were coming from abroad, and laboratory equipment purchases suffered delays.

- **Curriculum Development:** Developing and approving the curriculum took more time than expected and scheduling faculty to travel and teach for three weeks was often difficult because of prior commitments.
- **Student Research Expenses:** Research costs were higher than anyone anticipated causing delays while students sought additional funds to finance data collection and laboratory analysis. While students received research support funds, many PhD students struggled to find sufficient funding to complete their research. Every effort was made to help students find additional funding through scholarships or other means.
- **Finding Student Advisors:** It was difficult to find professional advisors from the stakeholder community to advise graduate students. Many potential advisors were concerned that the commitment required too much of their time. EIWR and UCONN developed creative alternatives for engaging industry experts and advisors, for example through seminars, feedback panels, etc.
- **Publishing Requirement for Graduation:** EIWR's original graduation policy stated that students were required to publish three journal articles in order to graduate. This was challenging for the students and for the faculty advisors supporting them. EIWR revised its curriculum and graduation requirements to align with the AAU policies, which only requires one publication. However, publishing one article was still difficult. EIWR did not realize that they would need to purchase additional equipment and recruit external international faculty to train the students on the equipment before they could start their research. The partnership set high expectations for its graduates, and in this instance, too high. In comparison to other doctoral programs around the globe, EIWR's requirements were more rigorous. Many doctoral programs do not require any publications, let alone three.

Outreach Challenge – Kori Afar De-fluoridation project: While EIWR did successfully manage the construction of latrines and water points at two elementary schools in Hawassa, the institute was unable to successfully install a de-fluoridation system in Kori Afar. In part, this was because Kori's remote location, poor roads, and the distance to the implementation site, created tremendous challenges, but also because the staff managing the project did not have the project

management skills and resources required for a project of this complexity. In retrospect, it might have been better to collaborate with an NGO with experience implementing construction projects in challenging areas. As it was, the learning curve was steep for EIWR and drew considerable resources away from other activities. It might have worked better to test the de-fluoridation technology at a more accessible site, allowing the institute to focus more on piloting and perfecting the technology before implementing at a remote site. This approach may have been more in line with the role of an academic research institute and could have potentially accomplished more in the long run.

3.3 Lessons Learned

Program Institutionalization: Establishing an institute takes time and patience. Ensuring a strong, financially sustainable research institute requires persistence and endurance. Relationships need to be built, a track record for research and policy development should be established, institutional structures need to be created, and capabilities and successes should be communicated to a broader audience. EIWR is learning to balance the responsibilities of being its own entity, while still adhering to AAU policies. Because of a closer working relationship with AAU management that developed over the past couple years, AAU helped EIWR streamline student transcripts and identity cards through the registrar office and provided funds for new faculty hires at EIWR. However, the EIWR developed its own administrative practices for items related to laboratory access and vehicle use. EIWR has made great progress since this partnership began, but still needs time to grow.

- **Financial Support:** Financial support is needed to recruit female students. Female students applied in significantly greater numbers to the program when financial support was available. When financial support was not available for domestic higher education programs, top female students sought other international higher education opportunities.
- **Relationships with Partner Universities**: Relationships with partner universities need to grow. Communities can drive research if the proper relationships are in place - but these relationships have to develop over time. New ways of working with the partner universities need to be explored.

Community Outreach

- **Engaging community members during the design process:** Partners also learned to involve communities in identifying development needs and to create champions for change. During the summer undergraduate outreach program, open communication and closer collaboration with the community helped progress by engaging community members and policy makers at different levels. This helped to select appropriate technologies and interventions, even if it was challenging to align needs with available resources.
- **Improve Model for Innovative Research Activities:** Some of the project's greatest successes resulted from the community outreach activities but the outreach projects also pulled resources from other priorities, in part because the staff lacked experience in certain areas. EIWR staff members were not experts in

construction and contracting. For future projects, partners learned the importance of aligning staff skills with implementation requirements (engineering skills, research skills, contracting and construction, etc.) Perhaps it would have been better to set up a contract with a firm or NGO skilled at implementation in challenging areas. Another problem was that project implementation schedules did not always correspond well with the time needed for innovative research.

- **Undergraduate Experiences:** The undergraduate outreach experience helped build relationships with local communities; encouraged multi-disciplinary learning; provided training in outreach and research to students; and encouraged students to go into health fields. Students reported that this was a life changing experience because it helped them to better understand the WASH challenges in their country.

Engaging Advisors and External Stakeholders:

- **Student Advisors:** Having a graduate program within an institute rather than a traditional university department presented challenges related to accessing advisors within AAU, as well as other stakeholders. The AAU management was instrumental in guiding the EIWR in tapping faculty members from other departments and helped to facilitate outreach to external stakeholders.
- **Student Connections with NGO's and Industry:** One of the program's goals was to promote collaboration with NGOs and other stakeholders through the students' research projects, which would significantly increase the impact of the research in addressing national needs. Partners tried to engage stakeholders to serve as research advisors to the students and invited them to numerous EIWR events. These types of collaboration, however, require time to develop and require monitoring and attention to ensure success. EIWR staff did not have a lot of experience within this area and would have benefited from more support in building student/industry partnerships.

Frequent Communication involving all parties: HED's monthly conference calls, involving UCONN, EIWR and USAID/Ethiopia, facilitated timely discussions and troubleshooting challenges in support of successful implementation, as well as creating common understanding on challenges and issues related to implementation. The calls provided guidance on issues such as developing monitoring and evaluation plans, budget utilization and realignment, faculty/staff travel, meeting organizations, etc. More frequent (sometimes-weekly) engagement and communication between UCONN and EIWR, contributed to improved implementation of activities and tracking of accomplishments, as well as troubleshooting, procurement and financial transfers and reporting.

Exposure to International Faculty: Bringing international faculty to teach in Ethiopia exposed students to a variety of teaching methods, courses, and critical thinking. Relationships between students and international faculty led to new teaching approaches, opportunities for internships, joint scholarship, and an expectation of standards. By bringing the faculty to Ethiopia, more students had the opportunity to benefit from the program than if the program had sent Ethiopians abroad. Students reported that they valued the seminars and saw them as

important learning opportunities. Students benefited from the relationships that EIWR developed with faculty from a large number of international universities who came to EIWR to present seminars. Students particularly enjoyed the open discourse - something not always found in their traditional classroom settings.

Collaborative Research: In a resource challenged environment, partners learned that it is critical to help graduate students focus on research topics in ways that lead to the most efficient use of resources and the strongest research results. There is a need for joint research projects, which allow several students to work on related topics, with newly collected primary data, and topics of critical relevance to water problems in Ethiopia. For the WREM students, partners successfully guided students toward research topics in ways that created research synergies and optimized use of the available laboratory equipment, faculty expertise, and funding available for research.

4. Sustainability

The Ethiopian Institute of Water Resources (EIWR) will improve the understanding of how best to manage, develop, and access water resources in a way that will lead to more resilient development solutions. The large numbers of joint research projects conducted during this partnership are already shedding light on water challenges. At the same time, the institute continues to train graduate faculty, using an educational model influenced by international researchers from around the world, who will return to Ethiopian universities to teach the ever-growing next generation of water resource managers.

Partners and the AAU management are committed to making EIWR a regional center of excellence in Water Resources. The integration of the WREM and W&H educational tracks into the AAU system is evidence of the institutional support for the programs beyond the close of the partnership. Additionally, financial support from the Ministry of Education and the Ministry of Water, Irrigation and Energy has further strengthened interest and investment by governmental agencies. The program has full support from UCONN. UCONN and EIWR will continue to work together to find ways to meet the goals of the Institute's long-term strategic plan which include building programs in water and agriculture and water and governance - areas critical for promoting sustainable economic development.

During the final year of implementation, partners developed a sustainability strategy that, based on HED's guidance, considered six core domains: (1) financial resource planning and management, (2) non-financial resource planning and management, (3) results-based management, (4) institutionalization of program within the university, (5) stakeholder engagement, and (6) relevance of program design. Partners will continue to reflect on these critical areas as they move forward into a new chapter of their partnership.

The partnership elevated EIWR's graduate programs to international program standards. The partnership's model was to bring a global perspective to all aspects of program development and implementation. The model involved bringing outstanding international and local faculty to teach courses in ways that would offer a world-class education in Ethiopia. The intent was to

expose students to a wide range of academic ideas, teaching styles, research practices, and viewpoints on critical water issues. The educational model provided opportunities for applied learning, new approaches to identifying critical research topics, primary data collection, and new analytical approaches. The partnership will sustain through the leadership and future success of its graduates, who will carry forward the goal of developing skilled professionals within Ethiopia's water sector.

5. Success Stories

1. Graduate Education

In June 2011, the Ethiopian Institute of Water Resources (EIWR) at Addis Ababa University admitted its first class of graduate students in its newly created Water Resources Engineering and Management (WREM) program. A total of 42 students – 18 Ph.D. and 24 M.Sc. – were selected for the program in its first year. Although the program was originally only able to support half this many students, additional support received from the Ethiopian Ministry of Education allowed for a significant increase in the number of students supported.

Adanech Yared worked as a lecturer at Arba Minch University prior to joining the WREM program to pursue her Ph.D. She also indicated the extreme challenges associated with studying abroad and was extremely happy to be selected to study at EIWR. She is excited to have the opportunity to do her dissertation research to help address problems in her country. The WREM program is the first of five graduate programs being developed as part of the Ethiopian – U.S. Partnership in Sustainable Water Resources in cooperation with five partnering Ethiopian universities. In the coming month, the WREM graduate students will begin their dissertation research which will address water related challenges in Ethiopia.

2. Undergraduate Summer Internships

Early involvement of undergraduate students in research is a important part of a vibrant higher education environment. To this end, the Ethiopian – U.S. Partnership in Sustainable Water Resources engaged 46 undergraduate students from its 5 partnering universities for two month internships this past summer. The students participated in 13 different community outreach projects in water supply and sanitation, watershed management, irrigation and general water works.

Melat Birhanu is a fourth year engineering student at Addis Ababa University. Her summer internship project focused on water, sanitation and health in the schools of the Lode Hitosa Woreda. For her and most of the other eight students on her project team, this was the first time that they would live outside of Addis Ababa and experience life in rural Ethiopia. "I never had a chance to experience rural community life before and the program was really helpful to introduce me to this part of our people," she said. "The lack of basic infrastructure and low quality of life are prevalent. This sad truth was a life changing experience for me." Speaking for her team, Melat concludes that the summer internship was a

great experience for all of them and that "it gave us a dream of what we could do and what we must do for our country and for our people, especially those in the rural communities."

3. Engaging students as agents of change in Ethiopia

The Ethiopian Institute of Water Resources (EIWR) recognizes that lack of exposure is one of many challenges that limit individual choices. In its outreach activities, the Water Institute in partnership with the University of Connecticut and USAID/HED financial support implemented a three-week water science training for best senior high school students from eight regions in Ethiopia. The purpose was to provide exposure to high school students on water issues in Ethiopia; motivating them to focus on water science related areas, and engineering in particular at university level.

During the closing ceremony, Abdirazak Ahmed Abdi a student from the Somali region noted a number of differences. He said, "... my school compared to Addis Ababa has no laboratory, enough textbooks, and other essential services." For Abdi, teaching methods were a new experience, he said, "it's my first time to learn something by projector ... use a microscope and video." Interaction and mentoring by EIWR graduate students was also an experience, Abdi said, "we were able to interact with Masters and PhD teachers "I never expected to have this exposure at high school level."

Commenting on the field trips, Abdi said, "I appreciate all the sites we visited, the Akaki waste water treatment plant and the medical laboratory." Citing the Legedadi water treatment plant, Abdi added, "I appreciate how the dam water is purified through different steps, and how water is distributed to the city residents."

The training was an initiative not only for students to learn about water issues, but also an opportunity to mentor, share experiences, appreciating each other's culture, and familiarizing students with campus life. In summary, Abdi adds, "I learned how to live with different students from different regions, and religion ... university is therefore a place where diversity and tolerance begins."
EIWR is making a significant contribution to climate change scholarship through the training of highly qualified Ph.D. candidates.

4. A young Ethiopian researcher with better skills to better challenges of address climate change and energy production efficiency

Elias Tedla is a student among the institute's first Ph.D. students who spent three months working at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, partly funded by the Early Career Scientists Assembly visitors Fund. While at NCAR, Elias has been conducting research on "Multi-Reservoirs Operation Optimization under Different climatic Scenarios to maximize energy Production Efficiency". The research looks at the relationship between climate change, water resources, and energy production. This opportunity was. In addition, Elias recently won the 2013 Intergovernmental panel for Climate change (IPCC) Young Researcher Award by the Monaco foundation.

Elias said, "I gained new and improved skills and knowledge working with professionals NCAR who have ample experience in their career". He further stated, "I feel this is one of the few fine

opportunities I have got in my academic life. In general, I can't imagine how I could go this far in my dissertation work if I hadn't get a chance to be in Boulder".

5. **Improved opportunities to disseminate research results that impact society and policy**

Belete Berhanu Kidanewold is a Ph.D. student interested in hydrological modeling related to the interactions of catchment attributes on the rainfall runoff, has been doing an internship at Florida International University since July 2013. Belete has successfully published two papers, namely (1) GIS based Hydrological Zones and Geo-soil data base of Ethiopia, published on CATENA Volume 104, May 2013, Pages 21:31, and (2) Surface and Ground Water Resources of Ethiopia: Potentials and Challenges of Water Resources Development. Belete said, "I got valuable experience and time through the internship enabling me to fully devote to the research work. I also gained new knowledge through discussions and interaction with different researchers, including PhD students, post-doc researchers, and professors". He further noted, "This internship helped me to better conduct data analysis, gain experience and skills on manuscript writing through online trainings".

6. **Graduates from the first batch of Water Recourses Engineering and Management (WREM MSc) have had great success in their professional endeavors**.

Some have gone to their universities and become lecturers and researcher some have jobs at different organizations including the Ethiopian Institute of Agricultural Research, and Ethiopian Institute of Water Resources. Here is a profile of one of EIWR graduates and how our graduate program helped him achieve his professional goals.

Solomon Berhane G/Yohannes joined Mekelle University as a lecturer after graduation. He teaches courses on surface water hydrology, water and wastewater engineering, and water resource planning. He is also participating in research and project development. Furthermore, together with his advisors, he is in the process of publishing a book about runoff generation and hydrological modeling. Recently, Solomon was involved in community service in Tigray National Regional State Adi Gudeme Woreda District concerning irrigation and water efficiency analysis. Woreda struggles with a lack of water allocation, delivery and distribution rules, which creates conflict among the farmers on using the limited amount of water in an efficient manner.

In respect to this, Solomon and his colleagues came up with a solution to distribute the irrigation water and the delivery at the farm gate through a rotational turning mechanism. In order to effectively use this mechanism the farmers organized themselves and selected a team leader. The main task of the team leader is to mobilize the farmers to work on structures; implementing water distribution rules and resolving water related conflicts. This traditional organizational structure made a significant contribution to sound and successful collective water management practices.

Solomon said that becoming involved in this task and directly working with community "helps me to gain a lot of experience and also got a chance to work with different professors from Mekelle University which helps me to learn more and develop my knowledge and skill in the area." He further noted that the program at EIWR helped him to succeed in his career and to develop a new perspective that contributes to his work "the experience and knowledge that I received at EIWR have been greatly instrumental in my present career which requires me to balance both teaching and research projects. I truly enjoy working in this field and I hope to progress further in my career and achieve bigger goals."

7. **Five Ethiopian Institute of Water Resources (EIWR) Water Resources Engineering and Management (WREM) PhD students received fellowships from different organizations**

Three students, Adanech Yared, Taye Alemayehu, and Yonas Girma, received the Norman E. Borlaug Leadership Enhancement in Agricultural Program (LEAP) fellowship. The value of the Borlaug LEAP grant is estimated to be 20,000USD. The fellowship aims to improve the standard of research among graduate students with leadership qualities and a scientific focus from developing nations. The students will conduct part of their research at University of Illinois, University of Connecticut, and Montclair University respectively.

In addition, Rahel Eshetu received a fellowship from the Organization for Women in Science for the Developing World (OWSD). The fellowship award of 18,000 USD is given to women scientists to follow postgraduate studies in natural sciences.

Furthermore, The Intergovernmental Panel for Climate Change (IPCC) along with funding partner Prince Albert II of Monaco Foundation awarded EIWR student Elias Tedla a scholarship for postgraduate studies/research for the period 2013-2014 within the framework of "Young Researchers Scholarship Initiative". Mr. Elias received the award in the category of "Climate and Water" with his research title of "Multi-Reservoir Operations Optimization under Different Climatic Scenarios to Maximize Energy Production Efficiency". Moreover, Elias also received the "Early Career Scientists Assembly Visitors Fund" award from the National Center for Atmospheric Research (NCAR).

8. **Educating Communities on Critical Moments of Hand-washing**

Poor sanitation and hygiene is a cross-cutting health concern in Ethiopia. Poor sanitation leads to diarrheal diseases, which is responsible for 22% of all deaths of children under five (UNICEF). Poor personal and household hygiene can lead to trachoma, increased rate of infections, and a number of other diseases. Ethiopia is on track to achieve the Millennium Development Goal target related to water, where 62 per cent of the population should access improved sources of drinking water by 2015. According to the 2011 Demographic Health Survey (EDHS), more than half of the households (54 per cent) have access to an improved source of drinking water, compared to

35 per cent in 2005 and 25 per cent only in 2000. However, the country is lagging behind on sanitation target. While the MDG target for access to improved sanitation facilities is 58 per cent, only 8.3 per cent of the population has access to improved sanitation. Encouragingly, 61.6 per cent of the population has access to some form of sanitation facilities.

Based on these facts the Ethiopian Institute Water Resources carried out its third summer community outreach/engagement program for undergraduate students from July 1-August 30, 2014. Students were given the opportunity to learn how to do community outreach and research, while learning how to work in interdisciplinary teams. The objective of the summer outreach activity was to provide students the opportunity to perform socially relevant outreach, thus uniting educational and research missions with community priorities and needs. Faculty from five partner universities (Addis Ababa, Arba Minch, Bahir Dar, Hawassa and Mekelle) helped to select students to participant, and to plan and implement the program.

A total of 96 (64 male and 32 female) undergraduate students from five EIWR partner universities were given opportunity to participate in the program. The selected students had backgrounds in the water science, social-sciences and health disciplines. The students spent 40 days within selected communities and worked in multi-disciplinary groups of three.
While in the field the students conducted surveys, completed observational checklists, and interviewed people in households. They also shared information on the critical moments of hand washing, the importance of safe cooking practices, the importance of separating animals and humans, the importance of having a safe water source like protected well and spring, vector control issues, etc.). They also distributed a two page hand washing poster which depicted the steps of hand washing and cleansing rituals.

The students reported that they valued the project because put them in the company of engaged, proactive, and passionate peers from different disciplines. They learned to work in teams and improved their research and community outreach skills. Some reported that the experience gave them the opportunity to learn more about the realities faced by people living in rural areas and piqued their interest in continuing graduate work in public health. They also gained the ability to synthesize their academic coursework with real world experience, learned the importance of developing context sensitive solutions that best serve the need of the local communities were pleased that they had an opportunity to give back to the community.

The project yielded some unexpected additional outcomes. The students' engagement initiated community interest in WaSH and communities started to demand their rights to sanitation from the government (e.g. AAU students' engagement in Sheno town). Student engagement also motivated Woreda government representatives to commit to responding to community demands and finding solutions to communities' problems.

9. School Latrines Up and Running

Schools are a learning environment for children. It is in schools that children gain knowledge that influence and stimulate changes in their attitudes and practices. One of the key school facilities that provides such changes are water supply stations, and sanitation and hygiene (WASH) facilities that children use daily.

Most of the schools in Ethiopia do not have a water supply or toilet facilities for sanitation and hygiene, and schools with toilets do not have hand-washing facilities. Where these facilities exist, they may be poorly designed and constructed or may not have sufficient water for hand washing. Toilets are not managed properly and many school toilets are unsanitary and unusable. As a result, school children often resort to open defecation.

Using this as a backdrop, the Ethiopian Institute of Water Resources (EIWR), in collaboration with Hawassa University through United States Agency for International Development (USAID) financial support, started constructing girls' latrine and water fountains in March 2014 at two primary schools in Hawassa, the capital city of the Southern Nations, Nationalities, and People Regional State. The two primary schools (Chefe Kote Jebessa and Busullo) chosen for this project were selected by EIWR's campus representative at Hawassa University in consultation with the Education Office of Hawassa City Administration. The schools are government schools and located near the main road of Hawassa city.

The day for the final inauguration and handover of the school latrines and water supply fountain finally came on 14 July, 2014. The children gathered on the school grounds as EIWR staff, announced that the latrines and water supply fountain were officially open. The director and teachers were visibly overjoyed, as were the children, particularly the girls.
The inauguration ceremony brought together local officials from Hawassa City Administration education and health offices, and representatives from USAID, Hawassa University, teachers, parents and students. As per the event schedule, the guests and EIWR team first went to "Chefe Koti Jebesa" Primary School. A total of 1,404 students are enrolled in this school out of which 792 are girls and 612 are boys. Next the guests proceeded to "Busulo" Primary School. A total of 1,830 students are enrolled out of which 965 are girls and 865 are boys.

The colorful inauguration event in Chefe Koti Jebesa and Busulo started with a site visit /tour of the school latrine and water supply fountain and explanation led by EIWR staff. The new girls latrine includes 4 seated latrine, 4 seated urinary seats and one sanitary room installed for girls in each school; of which one seat is designed and reserved primarily for disabled female students and staff; hand washing units as well as a drinking water fountain that would serve the school community. The basis of the adopted model for girl's latrine is the national standard design and construction manual endorsed by the Ministry of Health, Education and Water, Irrigation and Energy in collaboration with UNICEF. However, during the course of the planning EIWR noted the need for integrating the latrine design with special sanitary / menstrual room.

Accordingly, EIWR designed a new context-specific and demand-driven latrine facility. While adapting the original design and preparing this child-friendly model, EIWR carefully considered all local, state and federal codes and regulations in line with applying sound engineering judgments to suit contextual, societal, and cultural conditions.

After the visit, a brief key note addresses were delivered by different individuals including Mr Adem Shafi – the school Director, Dr Yilma Seleshi, Director of EIWR, Dr Fissha Getachew – Academic Vice President Delegate, Hawassa University, Mr Asefa Berhane USAID/Ethiopia and Mr Taye Biliso – Hawassa City Administration Education Department Head. All the

messages echoed the need for increased attention to the provision of safe water, the need for improved sanitation and hygiene in schools and communities, and the role of children as active agents of change towards improved sanitation and hygiene for healthy living.

In his key note address Ato Adem Shafi, Chefe Koti Jebesa Primary School Director stressed that school children are agents of change to the communities, particularly in the use and management of water supply and sanitation facilities, therefore by focusing on school children and, providing them with the necessary tools and knowledge to change behaviors at school, children play a crucial role in sharing information and knowledge with their parents, family members and the community to achieve better health, environmental, sanitation and hygiene practices. He finally thanked EIWR, Hawassa University and USAID for the tremendous support and in making the dream come true for the school children.

In his keynote address, Mr Taye Biliso – Hawassa City Administration Education Department Head, noting the exceptional progress in providing children access to education in the country as a whole and in the regions in particular, said that the next step will be ensuring quality of education. To address this issue the government has designed and started to implement a quality education package. He added that improved facility is one of the key factors which have had a positive impact on quality and in improving the learning environment. The government is working on improving school facilities and making schools conducive for children. He stressed that his office will replicate the innovative latrine in other schools.

In both schools students read poems, sang, and staged short but very educative dramas in a local language and Amharic to illustrate the importance of hand washing before and after eating, after using the toilet etc. One student poem said:
Wash your face and hands with soap,
Where soap is not available
Hands can be washed with ash and water
Wash them every day
Will help keep germs away

The parents and the teachers also expressed a lot of enthusiasm and commitment towards the success of the project stating that the benefits of the projects have been felt around the community. One mother at Busulo primary school expressed her utmost gratitude to EIWR and USAID for giving the school a new face by providing them with quality sanitation facilities. She added that in the past the challenge posed a great problem for girl pupils, who used to bet absent from school as they were not comfortable staying at a school that has inappropriate and inadequate toilets and sanitary room.

10. Becoming a Leader

Graduates from EIWR's master degree program in Water and Health have had great success in their professional endeavours. Some have gone back to their home universities and become lecturers and researchers and others have found

jobs at organizations such as the Ministry of Health, the Ministry of Water, Irrigation and Energy, and the Leather Industry Development Institute. Here is a profile of one EIWR graduate who explains how EIWR's graduate program helped her achieve her professional goals.

Tsega Menhasebo G/Hiwet is a graduate from EIWR's Water and Health program with an emphasis in Water and Public Health. Currently, she is working in a not-for-profit, non-governmental organization called Children Burn Care Foundation as the Program Coordinator where her responsibility is to develop a burn prevention program that will work within the cultural context of Ethiopia. She will develop educational materials to spread awareness and to advocate for safety measures that will hopefully reduce the burn incidents in our country.

Tsega said that during her educational journey at EIWR, there were challenges which became opportunities for building and applying leadership skills. She remembers a remarkable comment made by Dr. Mekonnen Gebremichael who told her and her fellow students that the aim of the program was not only to teach the students and give them their respective Master or Doctoral degrees but to bring out their leadership skills and help them to become the next leaders in their respective fields. For Tsega this meant tackling each challenge in cooperation with fellow students, teachers, and the staff. The faculty at EIWR taught her to look beyond the challenges she faces at work and to worker harder to achieve her desired goal - no matter what.

During her graduate program, Tsega became the representative of the master's students and had to deal with a variety of student issues. She said that this additional task helped her to develop her communication skills, since she had to resolve issues between teachers and students, students and staff, and among the students themselves.

"I had to learn a great deal of patience and tolerance while in this position, engaging students, giving them tasks, coordinating activities, and organizing ideas to present to the administration in a coherent way. I organized the students for different occasions, activities and tasks, advocating and introducing our program to different organizations and completing other important tasks as a representative of the class. All these activities helped me to develop my leadership skills and to work as a program coordinator in my current job."

Tsega further noted that the program at EIWR helped her to improve her research skills. She said "the main thing that got me interested in my current job was that it involved research. If I am asked what one thing I learned and valued most from my experience at EIWR, it would be learning about research; new findings, unravelling existing facts and working for the good of the public. I now conduct research in my new job to learn and produce a prevention program that is suitable to the context of Ethiopia."

Finally, she adds "as EIWR intended, I have become a leader in my project and I hope to do more for my country because of what I have learned and attained."

11. A Health Care Provider Works to Promote better Sanitation Practices

Eftu Abi is one of 38,000 rural health extension workers in Ethiopia. She practices at a health post in Sheno Woreda, Indode Washa Kebele in the northeastern part of the country. She spends her time at the health post and visiting families in their homes. She has wide-ranging responsibilities for community-based health promotion and curative care in Indode Washa Kebele. Her workload is diverse, and over the course of a week, she divides her time between activities relating to family health, disease prevention and control, hygiene and sanitation, and other activities.

In November and December 2014, The Ethiopian Institute of Water Resources of Addis Ababa University organized a three-day training workshop for 100 health extension workers from four regions on how to engage and train communities on potable water, sanitation and hygiene practices. The workshops were held in Arbaminch, Bahir Dar, Hawassa, Mekelle and Sheno.

Eftu was one of the participants of this training at the Sheno site. Eftu said that the training enhanced her knowledge and workplace performance. She valued the participatory approach of the training with the chance to share her own experiences with other health extension workers. She added that the training helped her to learn how water is contaminated from source to the household level, how to select proper sites for WASH facilities, the connection between sanitation and water, to name a few.

"The training is the most useful and productive experience. I am now confident in successfully applying/implementing my new skills in my daily work at the community," she says.

Her plan for the future is to continue applying the concepts presented at the training to increase community awareness in health through the involvement of communities and provision of continued health education and promotion to bring about positive changes in the knowledge, attitude and behavior of the community.

12. Health Extension Worker Training: Key Findings from Post Training Evaluation

The Health Extension Worker Training was a success story for several reasons. Partners reached 100 workers at five different locations in Ethiopia, 48% of which who had never received a similar training before. One participant commented that, "the training completely changed my knowledge of water, sanitation, and personal hygiene." Of those who had received similar training, the majority said that this training was more successful than other trainings they had received. The training was successful on three fronts; 1) the presentation was effective and well received; 2) the content addressed the connection between sanitation and water, a connection which many reported hearing for the first

time; and 3) the workers were actually provided with training on how to engage their local communities.

The training delivery was considered extremely effective by many participants who:
- valued its efficient use of time, clarity, the respect with which the participants were treated, the communication style, the hand-outs
- valued the approach which emphasized problem identification
- valued hearing about experiences from other areas, particularly their strengths and weaknesses.
- valued the participatory approach with the chance to share their own experiences.

Even more importantly, the participants reported that it increased their awareness, knowledge and understanding of critical WASH related concepts during the training;
- improved knowledge of water, sanitation and hygiene
- helped to correct wrong assumptions about water and sanitation
- increased understanding of how water and sanitation are interrelated
- learned how water is contaminated from source to the household level
- learned the importance of team work and inter-sectorial collaboration
- learned how to assess community's WASH problems
- learned how to engage the community in implementing WASH activities
- learned how to select proper sites for WASH facilities

Some participants felt that the trainings were too rushed and would have liked to have more time. Others said that it would have been helpful to have the manuals in the local languages. When asked what additional training they would like to have, the participants said they would like training on how water is related to malaria breeding; how to differentiate polluted and non-polluted water; pregnant women and health related to water, etc. They would also like training on how they can help their own communities themselves.

Two of the health extension workers from Sheno Town, who received training said that they had learned a lot from the training and that they were trying to share their new knowledge with the community. They felt that they were better able to explain how actions led to better health outcomes. One change in the community was that the community now cleans up human waste every Friday and transports it to a place where it is burned. The health officer said that stomach problems had decreased from the third most common complaint at the health office to the 7th most common.

6. Appendices

Appendix A: University of Connecticut/Addis Ababa University Final Report



Addis Ababa University and University of Connecticut Partnership

"Sustainable Water Resources: Capacity Building in Education, Research and Outreach"

FINAL REPORT
July 2015

USAID/ HED 052-9740-ETH-11-01
Cooperative Agreement # AEG-A-00-05-00007-00 Associate
Cooperative Agreement # AID-663-LA-11-00001

Higher Education for Development was established in 1992 by the six major U.S. higher education associations to engage the higher education community in global development.

American Council on Education (ACE) | American Association of Community Colleges (AACC) | American Association of State Colleges and Universities (AASCU) | Association of American Universities (AAU) | National Association of Independent Colleges and Universities (NAICU) | Association of Public and Land-Grant Universities (APLU)

Table of Contents

Executive Summary

Since its inception in 2010, The UCONN/Addis Ababa University Partnership has made substantial progress towards establishing a world class graduate program dedicated to education and research on water resource management issues to address Ethiopia's needs for water resource professionals and skilled faculty to teach students. The Partnership's most important accomplishment has been to establish the Ethiopian Institute of Water Resources (EIWR) which is Ethiopia's first institute dedicated to addressing critical water related challenges at a national and regional level.

EIWR has established four new academic programs and courses in water related areas with strong input from a broad range of stakeholders To date, EIWR has enrolled 117 students in their M.S. and Ph.D. programs in Water Resources Engineering & Management and Water and Health, while bringing new teaching methods and critical thinking skills to the classroom. With state of the art research equipment, EIWR has been able to initiate high quality joint research projects in collaboration with international scholars and local faculty from other universities and departments. During the last few years, EIWR's capacity for outreach, networking and community engagement has also grown as they worked collaboratively with UCONN to design innovative trainings, experiential learning activities, and innovative solutions to community water access challenges.

As with most academic institutes, the Partnership's s focus has been on education, research and community outreach. The Partnership's objectives were:

1. Increased Capacity at AAU and Partners Institutions to Provide High Quality Education
2. Increased Ability to Teach and Conduct Research
3. Increased Ability to Publish Research and Apply Research Findings
4. Improved AAU's Capacity to enhance community commitment to implement sustainable solutions

Education

To date, forty-one students have successfully graduated from the EIWR's graduate programs. This spring, EIWR awarded its first two doctoral degrees in Water Resources Engineering & Management (WREM) to graduates who exemplify the high quality of students in their programs. Both students have published in international journals, won scholarships and internships at international research institutions, and successfully conducted nationally relevant research. In addition, 39 master's degree students successfully graduated from both the Water & Health and WREM programs. Many of these students were previously faculty from other Ethiopian universities who were teaching even though they have only completed a Bachelor's degrees. Most of them will return to their home institutions to teach hundreds of new undergraduate students bringing new teaching skills and approaches learned through their EIWR graduate courses and experiences. The partnership achieved these outcomes by engaging over 30 international faculty in the work of building the institute while using their skills as teachers, advisors, and research partners to enhance learning and expose students to a wide range of

ideas. EIWR benefited from visiting faculty providing seminars which were highly valued by the students for providing opportunities for indepth discussions and open dialogue.

Research

Building the capacity for research has been an important accomplishment of the Partnership and EIWR. Bringing state-of the art equipment, such as the eddy covariance gas analyzer, to Ethiopia both for research and data collection was critical to the research mission. Students exposed to new equipment and technologies increased their technical skills in equipment operations and management and saw the potential for new research designs. The equipment created opportunities for primary data collection in areas never researched before. The availability of new time series data sets increased the Institute's capacity to study some of Ethiopia's greatest water related challenges.

A strong cadre of international advisors working together with faculty from local universities taught students research design, analysis, and presentation skills. Research coordinators helped to keep student research on track , access to UCONN's electronic library gave students access to millions of academic publications, and a copy editor helped non-native English speakers prepare to publish in international journals.

In the process of building its research capacity, the Partnership established a strong international network of universities, researchers, and institutions interested in research collaboration. EIWR laid the foundation for ongoing and future research partnerships and academic exchanges through student internships, faculty teaching and research exchanges, and the establishment of research sites.

Building research capacity has had challenges. Setting up research experiments can be costly when equipment needs protection and research sites are remote; importing equipment is time consuming and costly; and starting joint research projects with international teams requires considerable planning and coordination. Expanding indoor research laboratories requires lab space that meets safety and scientific standards, and with EIWR at a temporary site, not all of these resources are yet available. These challenges can cause research delays and impede student research progress.

Outreach Capacity

EIWR's community outreach implementation activities not only brought resources and skills to communities but also helped EIWR to move forward on the community extension and collaboration learning curve. Successfully implementing school latrines and water fountains in Hawassa helped to bring accessible water and sanitation to hundreds of school children and teachers, but also gave EIWR valuable experience in how to work with communities to build solutions that best meet their needs. Implementing a highly successful undergraduate experiential learning experience not only gave students an excellent opportunity to learn about community engagement and research, but also gave EIWR the opportunity to collaborate with partner universities in the process of planning and implementing activities. And finally, after

training health extension workers in four different regions in Ethiopia on the connections between water and health, even the trainers were surprised by how highly the participants valued a training that emphasized the connections between water and health. For EIWR staff this reinforced the importance of using a multi-disciplinary approach to problem solving and value of using participatory approaches when providing training.

EIWR encountered many challenges while implementing its community outreach activities, some beyond the scope of a research institute. Activities went beyond building prototypes and lab-scale models to implementing projects which required project management skills and resources - often to the detriment of other activities. However, each activity offered a valuable learning experience. In the case of the Kori defluoridation project, the partnership learned how costly it can be to pilot large scale new technologies in remote areas.

Institutional Development

Developing a highly functioning, self-supporting, academic research institute takes time and patience. Institutional standards, procedures; relationships, protocols, and facilities development all take time to develop and refine. The Institute now has experience managing graduate students; complex outreach projects, and large international grants. Protocols for everything from financial procedures to implementing innovative technology have now been established as have communication tools such as an active website, newsletters, and a regular research symposium.

Section 1: Development Context

Developing Sustainable Solutions to Water Challenges through Education and Research

Water resource management is a cross cutting issue that can prevent or promote sustainable development. A lack of access to clean water and water for production can disproportionately affect community health and economic productivity. Agriculture, for example, is a vital sector in Ethiopia for over 80 million people, accounting for 42 percent of GDP and employing more than 85 percent of the labor force (more than 40 million peoples). Most farmers are dependent on rain-fed agriculture but struggle on lands that are highly degraded and in need of sustainable soil and water conservation interventions. Irrigated agriculture (from micro to large scales) is contributing more and more to the economic sector, but with no proven irrigation water governance system for community managed irrigation schemes, water technology access challenges, and little knowledge about local hydrological systems, many attempted irrigation schemes fail.

Good sanitation and hygiene and access to potable water also depend heavily on the availability of sustainable water access and distribution systems. Poor sanitation leads to diarrheal diseases, which are responsible for 22% of all deaths of children under five (UNICEF). Poor personal and household hygiene can lead to trachoma, increased rate of infections, and a number of other diseases. While there have been many improvements in WASH systems, still only 54% of households have access to improved drinking water and only 61.6 per cent of households have access to some form of sanitation.

Ethiopia has a need for research and development that addresses these water challenges and for faculty to train the next generation of water resource managers. The number of students attending college in Ethiopia has grown rapidly and universities have struggled to find skilled faculty to meet the increase in demand. Enrollment in undergraduate degree programs in Ethiopia increased from 138,159 (with 24% females) in 2004 to 447,693 (with 27% females) in 2011. Enrollment in post-graduate degree programs increased from 3,604 (with 9.2% females) to 20,150 (with 13.8% females) during the same period (MOE 2011).

Women Collecting Water near Bahir Dar

As one university administrator commented, "Our problem is a lack of staff. Universities opened more quickly than Ethiopian engineers and educators could earn higher degrees. Most lecturers … only have bachelor's degrees. …. The growing pains are most acutely felt in engineering laboratories, which were always under-equipped and now are overcrowded as well " PRISM: Growing Pains. American Society for Engineering Education . May 2015.
http://www.asee-prism.org/growing-pains-marapr/

Based on Ethiopia's critical need for sustainably managed water systems and resources and the need for faculty to train future generations of water managers and researchers, Addis Ababa University and the University of Connecticut (AAU-UCONN) formed a partnership to establish a new institute for water resources management which would develop graduate programs with both Master's and Ph.D. students, conduct research key to managing water resources, and engage communities in improving water access and systems. The UConn/AAU partnership chose project objectives consistent with the Ethiopian Government's strategy of accelerated sustainable development and eradication of poverty. The partnership objectives aligned closely with the mandates of many government ministries including the ministries concerned with education, water resources, health, energy, and agriculture.

Establishing a water resources institute, the Ethiopian Institute of Water Resources (EIWR), dedicated to improving the understanding of Ethiopia's complex and cross-sectoral water resources issues will improve the understanding of how best to manage, develop, and access water resources in a way that will lead to more resilient development solutions. The large numbers of joint research projects performed are already shedding light on water challenges. At the same time, the institute continues to train graduate faculty, using an educational model influenced by international researchers from around the world, who will return to Ethiopian universities to teach the ever growing next generation of water resource managers.

Section 2: Results by Objective

Objective 1: Increased ability at AAU and partner Institution to offer high quality education

Project Outcome: AAU offers degree programs related to water resources

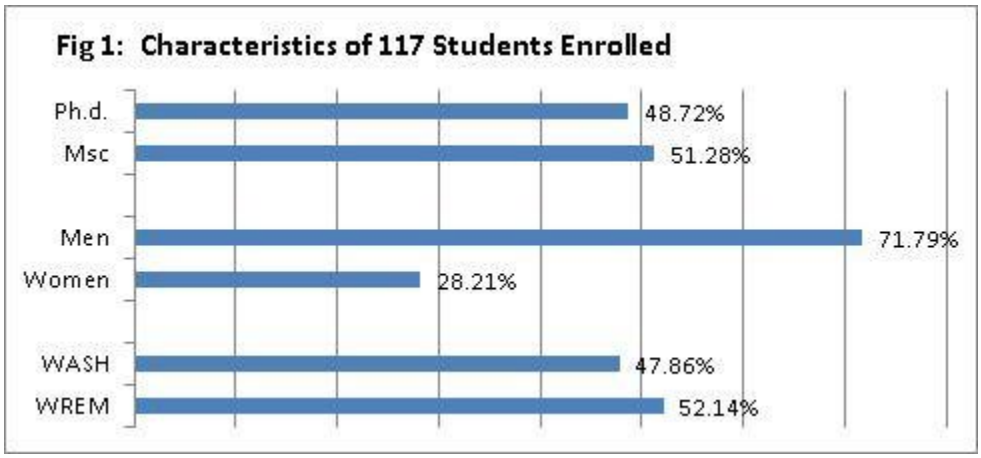
New Programs in Water Resources :The UCONN/AAU Partnership established four graduate programs including a Msc and PhD program in Water Resources Engineering & Management (WREM) and Water & Health (W&H). With the participation of a wide range of stakeholders including local and international faculty, local NGO's (e.g. WHO and UNICEF), and government representatives, the partnership developed curriculum for each WREM program and for two tracks (Water & Public Health and Water and Wastewater Treatment) within the W&H program. The course requirements were significantly enhanced by wide stakeholder participation so that course work not normally in an academic curriculum, such as water safety planning, but of vital interest to the sector were included. All courses involved experiential learning .

International Program Standards Achieved : the Partnership's model was to bring a global perspective to all aspects of program development and implementation. The model involved bringing outstanding international and local faculty to teach courses in ways that would provide a world class education in Ethiopia. The intent was to expose students to a wide range of academic ideas, teaching styles, research practices, and viewpoints on critical water issues. The educational model provided opportunities for applied learning, new approaches to identifying critical research topics, primary data collection, and new analytical approaches.

Student Enrollment High: Student enrollment exceeded expectations demonstrating the high demand for quality water resources graduate programs. The project hoped to enroll a total of 50

EIWR Graduates July 2014

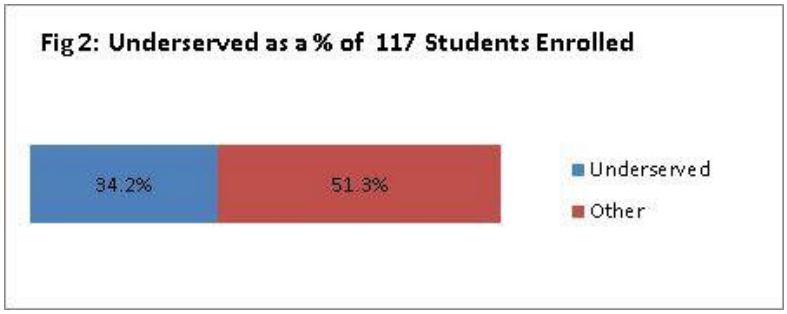
students and ultimately enrolled 117. Of the students enrolled, 51% were masters students, 28% women, and 52% WASH program students. (See Fig.1)



Of the 117 students enrolled over the course of the program, 81 students (46 MSc and 35 PhD) students received USAID support for housing and research. Thirty-six more students enrolled in FY14 after housing allowances and research support ended.

Underserved Students Enrolled:

EIWR admitted 40 underserved students (including 33 females) out of 117 students (34%) between 2011 and 2015 (See Fig. 2). For the W&H programs it was higher - 46% (26 out of 57) were underserved with 4 males from the underserved regions of Afar, Benshangul, Somali, and Gambella. EIWR policies dictate that 10% should be from underserved areas and 50% of new enrollees should be women. The percentage of underserved students enrolled was higher when the students were supported by the USAID project.



Objective 2: Improved human capacity at AAU and Partner Institutions to teach and conduct research in WREM and WASH

Project Outcome - Improved Research and Teaching Skills

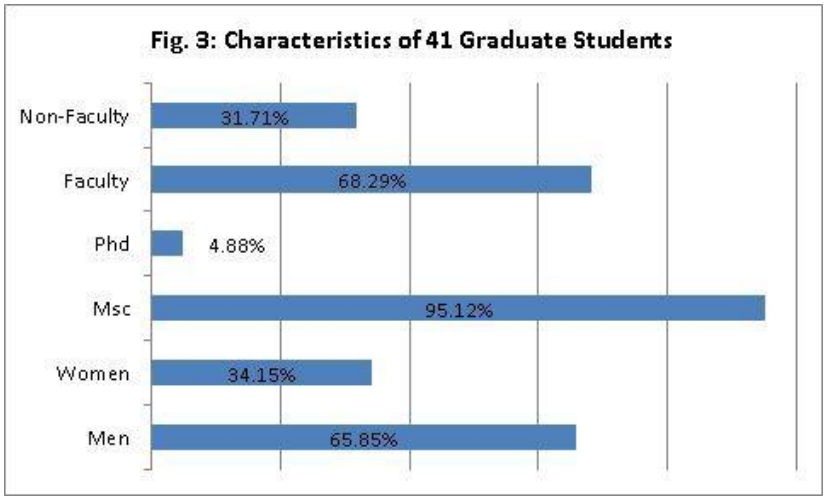
The graduate programs at EIWR have contributed to improving the research and teaching skills of 71 faculty from Ethiopian universities. To date, 28 faculty completed their degrees (26 Msc and 2 PhD) and will return to universities to teach. (See Success Stories about PhD graduates in Appendix A) Graduates not affiliated with universities are finding jobs in the non-profit, government, and private

sectors. One graduate is a Climate Science Center National Program Officer and Greenhouse Gases MRV Unit Leader; another is an advisor on green zone development around Lake Hawassa in a project funded by the Strategic Climate Institutions Program, and a third is a WASH Emergency Coordinator and Sector Support Director at the Ministry of Water, Irrigation and Energy.

This spring, the Institute graduated the country's first PhD. students in Water Resource Engineering and Management. Elias Teda from Hawassa University and Belete Belete Berhanu Kidaneweldof from Addis Ababa University are both returning to their home universities to teach.

So far, 42 students have graduated from from programs offered at EIWR. Over a third of graduates have been women. (See characteristics of graduates in Fig. 3)

Elias Teda Defending Doctoral Dissertation - May 2015



Seminars:

EIWR hosted 40 seminars or other short-term trainings for students and staff since 2012 with 684 people registering to attend. (See Appendix B for Short-term Trainings and Seminars) Students reported that they highly valued these opportunities for discussion and discourse and the opportunity to think deeply about specific topics.

Seminars for EIWR Students

Students Demonstrate Progress on Skills Assessment:

When asked how their teaching and research skills have

improved, all of those students surveyed reported having stronger skills in all teaching and research areas. The areas where students felt that their skills increased the most included:

1. Knowledge about research publications in subject area.
2. Ability to use electronic library
3. Ability to choose appropriate methodology to study research question
4. Ability to present research design
5. Ability to synthesize literature

These students also benefited from the global, multi-disciplinary, and professional staff which demonstrated state of the art teaching methods and a variety of teaching styles, brought global perspectives to discussions, and brought a real life perspective to discussions on research priorities and results.

The options for learning outside the classroom through experiential learning opportunities and short-term seminars on a wide range of topics also provided value to the education. Students reported highly valuing the seminars because they offered opportunities for lively discussion, a highly concentrated focus on a single topic, and exposure to a wide range of ideas. EIWR hosted 40 seminars or other short-term trainings for students and staff.

Students Learn to Present Papers and Write Academic Publications

Over 30 students have attended international conferences; 3 students have had papers accepted by academic journals and 2 others have submitted papers.

Project Outcomes: Improved Instructional Resources

The Partnership made significant progress towards helping EIWR to improve its instructional resources by purchasing state of the art research equipment and making it available for research. (e.g. gas analyzer, rain gauges, hydrology equipment, water testing equipment). EIWR held trainings for students on how to use the research equipment; established research sites to collect primary data; installed modeling and statistical software (Riverware, SPSS) in some of the six research laboratories enhanced or developed over the course of the project; and maintained instructional materials from courses in an institute database (see more details on individual labs below).

Resources provided through UConn added value to the program. All students were given access to the UConn electronic library for their research and students writing research publications worked with an editor from UConn to prepare their papers for international journals. This was helpful because the students didn't have the same opportunities to improve their english language skills as students studying abroad. The writing support was critical for the Ph.D. students who need to meet the AAU requirement for publishing.

Laboratories and Field Research Sites

1. **The Hydro-informatics laboratories** are located at the EIWR Akaki campus in two rooms. The hydro-informatics labs are used to simulate hydrological processes of a watershed and to undertake spatial and temporal analysis of data. The software installed to improve these laboratories included SPSS 20, GIS 9.3, Epi Info 7, Riverware, and Google Earth.

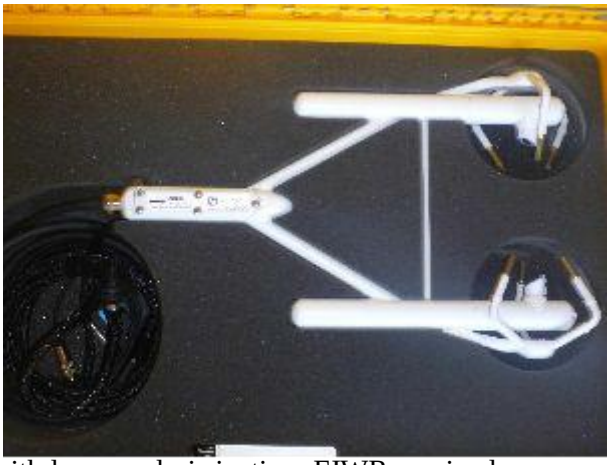
2. **Blue Nile Rain Gauges Network:** In 2012, EIWR installed 60 tipping-bucket rain gauges and five automatic weather stations across the Blue Nile basin from which staff and students collect data every six months These stations generate reliable information on rainfall characteristics over the complex terrain in that region. Teachers use the collected data in the classroom and students use the data for research. Three graduate students recently conducted research using the weather data on the following topics.
    a. "Effect of Topography in Satellite Rainfall Estimation Errors: Observational Evidence across Contrasting Elevation in the Blue Nile Basin." By: Gebrehiwot Niguse
    b. "Effect of Topography on Rainy Season Rainfall Variability over the Blue Nile River Basin, Ethiopia." By: Shambel Habte
    c. "Spatial and Temporal Rainfall Variability and its Effect on StreamFlow: The Case of Birr Watershed." By: Nebyou Solomon

    EIWR performs routine maintenance of rain gauge and weather stations and data downloading every six months. Staff regularly work to improve sites when the gauges need better protection. It is uncertain how EIWR will be able to maintain this site after funding from USAID has ended.

3. **Hydrology Research Site** - Awash Basin: EIWR installed a hydrological measuring station in the Awash Basin around Melka Konture that will generate primary data for modelling runoff and erosion processes in the Ethiopian highlands. A team consisting of professors from the University of Tubingen, Germany and University of California, Los Angeles (UCLA), and 2 PhD and 3 MSc WREM students, established the site. The trip created a good opportunity for the students to understand the land degradation and hydrological processes of a tropical black cotton soil. These students undertook field measurements, such as infiltration, soil moisture, hydraulic conductivity, etc. In addition, they installed sensors measuring rainfall, vertical profile of soil moisture across a hillslope, and overland flow at the Melka Konture watershed.

Hydrological Measuring Station

4. **Gas Analyzer at Wonji Sugar Factory**: The Eddy Covariance system measures the amount of actual evapotranspiration (i.e. the amount of water needed) from an agricultural field. This can be used for (i) irrigation scheduling, and (2) quantifying how much water is needed for an acre of land. After training students and staff how to maintain and calibrate the equipment, a Ph.D. student installed the gas analyzer at the Wonji Sugar Factory. The farm is one of the first sugarcane state farms in Ethiopia. It is about seven thousand square kilometres, and is located in the upper Awash Basin which is one of basins with large scale irrigation. EIWR received permission to install the equipment at the farm and interested students can use this instrument to conduct their research work.



5. **Malaria Research Site in Ghibe Basin**: In collaboration with researchers from UCONN and Jimma University, EIWR established a malaria field research site that will generate comprehensive field data to investigate the dynamics of climatic, ecological, anthropogenic factors as drivers of malaria transmission in low-elevation and higher-elevation areas. This complex and poorly understood dynamic plays a key role in determining malaria risk. To select the study sites, the team visited urban and rural areas at different elevations in the Wolkite-Jimma and Wolkite-Tolay transects across the Ghibe Basin. The study sites were selected based on differences in altitude, land use patterns, hydrological features and proximity. During the selection process, focus was given to identify and consolidate specific study sites with manageable size and avoid overstretching efforts, time and resources conduct more intensive sampling in depth and frequency carry out repeated sampling and generate data for statistical analysis. In addition, the team made several field observations which will be used to refine research questions and methodologies.

Mosquito trap hanging near cattle corral

6. **Water Quality Laboratory**: EIWR has started to establish a water and wastewater quality laboratory. The PhD students in the Water and Health track who are doing research on wastewater treatment need these supplies to complete their dissertation research. So far the following water and wastewater laboratory reagents and equipments are purchased and available for research and teaching: chemical oxygen demand (COD) reagents, acidity and alkalinity reagents, test tubes, pipettes, beakers, volumetric flask, measuring cylinder, brushes

for flask and cylinder washing, Biological oxygen demand test (BOD) bottles, imhoff cone and imhoff con racks for sludge settleability test, autoclave, and safety cabinet.

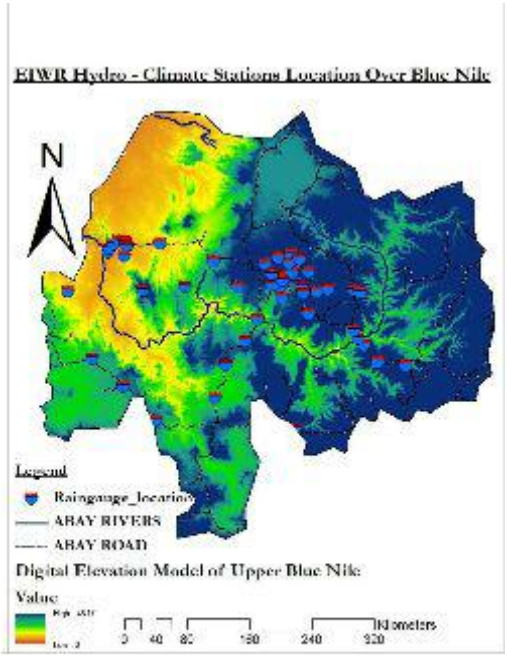
Students and Staff more Skilled at Using State-of the Art Research Equipment and Software

International faculty trained students and staff how to set-up, operate and maintain a wide variety of research equipment. Dr. Niles from University of Khartoum spent a week at EIWR teaching students and staff how to set up, run and maintain the gas analyzer. EIWR hopes to do collaborative work with Dr. NIles using this equipment in the future. Dr. Mekonnen Gebremichael from UCLA took groups of researchers and students to the field to learn how to use hydrology equipment. Seminars were provided on how to use GIS software and one student traveled to Tanzania to learn SAS statistical software.

Students learning to use Gas Analyzer

Critical Water Resource Data Captured and used in Student Research - Data Matters

The UCONN/AAU Partnership significantly increased the number of educational resources available for data collection and research and the Institute's capacity to utilize these resources. The overwhelming consensus from early workshops on program development was that resources should be invested in field data collection because of the gap in data for research on critical water related research questions. Consequently, the Partnership invested significantly in purchasing state-of the art research equipment and software for indoor and outdoor laboratories. Among others, the partnership deployed rain gauges, hydrology equipment, and an eddy covariance gas analyzer to collect data measurements used by multiple graduate students in their dissertation research. (See full description of equipment and research, research objectives, and locations of research sites.) EIWR does not currently have a suitable space for a water quality laboratory, however, AAU intends to build a facility over the next few years.



Rain Gauge Locations in Blue Nile Region

These new educational resources allowed for a transformation of the graduate research experience in the water resource area. Our students had to design field experiments, collect real data, and pursue approaches relevant for Ethiopian conditions. This is a paradigm-shift in Ethiopia, where most graduate students had to use

"synthetic" or "existing data" to just play with models developed and tested outside of Ethiopia, just to get a degree. Research planning with international faculty participation was very effective, particularly during the first WREM program when a faculty team supported the generation of research topics.

Students Access to an Electronic Library for the first time: Another improvement in instructional resources included providing all students access to the electronic library at UCONN where they had access to the same large set of academic publications as UCONN students. For most students, this was the first time that they had easy access to large numbers of academic journals and publications.

Course Materials Documented for Future Use: The majority of courses for all four programs were taught by international faculty who developed syllabi and course materials for each class. Copies of all of these materials have been stored in a digital database for use by future students and teachers.

Project Outcome: Improved Advising and Counseling Capacity

Advising: International advisors, local advisors, and research coordinators who met with students during regular research planning seminars all helped to advise students. The research coordinators helped to ensure the scientific quality of student research and steady progress toward research goals. Students benefited from working with international advisors who used state of the art teaching methods, a range of teaching styles, and global and real life perspectives to lead discussions on research priorities and achieving results. Research planning with international faculty participation was very effective when it happened, and some students developed relationships with their international advisors which led to internships, lab research, joint research, and joint publications.

One of the challenges with advising was that students were located out at the Akaki campus rather than physically close to their advisors making frequent interactions more challenging. Another challenge was that local faculty did not always demonstrate a high level of commitment to EIWR students because they were not graduating from their own departments. Two structures were put in place to address these challenges. EIWR hired four research coordinators to supervise students at Akaki in research groups during weekly seminars. During these meetings, the coordinators helped keep students on target with planning their research by providing guidance and structure. They could advise students; problem solve, and address overarching issues with EIWR staff. The advisors provided some continuity and regular contact with students. The local university advisors benefited from interactions with international advisors focusing on common student's work; having students with access to unique research resource (field data, access to electronic journals through UCONN's library, highly specialized software such as IDL, Riverware, etc); and from having the opportunity to advise highly motivated Ph.D. students on water related topics.

Objective 3: Improve capacity to publish research and develop market applications

Project Outcome: Innovative research projects adopted and implemented

Students initiated 81 research projects over the last five years and have completed 41 to date. Most of the 39 master's students completed their research and degrees in two years time and many collected primary data. (See a list of graduates and their research topics in Append C)

Students Research Projects

- 41 research projects (theses and dissertations) implemented and defended.
- 28 Ph.D. students are at various stages of completing their research and publishing their results.
- 3 recently enrolled students have written research proposals designed to use data from outdoor laboratories.
- Master's Students collected primary data

Project Outcome: Joint Research Projects Implemented

EIWR Established a Strong Foundation for Future Growth in Joint Research Projects with Collaborative Partners:

The Partnership established a strong foundation for future research collaborations between stakeholders and other collaborative partners by building its research laboratory capacity; strengthening relationships with other educational institutions; providing access to critical data resources; and training students in research methods. The Partnership recently initiated several new joint research projects in tandem with the establishment of new outdoor research sites established under the guidance of Dr. Mekonnen Gebremichael, to study soil erosion and the connection between water sources and malaria. (See section on instructional resources for more detail)

The Partnership also initiated several collaborative research projects involving UConn and EIWR faculty and students. One project involves testing clay filtration pots produced by a local Ethiopian manufacturer for their effectiveness at purifying contaminated water. This highly cost effective approach has shown promise in other countries so the Partnership wanted to evaluate the potential of introducing clay pots for filtering water into local communities in Ethiopia but was having trouble finding clay pot samples to test. Dr. Jon Mellor, a new faculty member at UCONN, found a local producer in Ethiopia this spring and began having students at UCONN test the effectiveness of these filters this summer. The partnership also helped EIWR to build the capacity to test the filters so that they will be able to do a second round of testing in local communities.

Another project had a Senior Design team at UCONN study using Magnesium Oxide as an alternative to using activated alumina for defluoridation in Ethiopia. The senior design team consulted with one of the EIWR graduate students while doing the project and used data collected by EIWR as part of their work on defluoridation in Kori, Afar. EIWR produced a policy paper based on this research.

And finally, the UCONN chapter of Engineers without Borders has been working jointly with EIWR, Bahir Dar University, and a community in the Nile Basin to complete a project design for improving innovative water access technologies (such as a rope pump for irrigation). The president of EWB traveled to Ethiopia with Dr. Mellor and Yigrem Dingo, a graduate student in the Department of Civil Engineering, to meet with the community to discuss the proposed long-term irrigation project. The team also met with faculty and students from Bahir Dar University who are advising the students on Ethiopian culture, farming practices, and irrigation techniques.

Research Presentations at Workshops and Conferences

Students improved their research presentation skills by presenting their research at workshops, conferences, and at EIWR for advisors, professional stakeholders, staff and other students. EIWR organized the first annual research symposium in May 2014 where 24 students presented on their research progress to advisors and invited guests from NGOs such as WHO and UNICEF, all of which participated in active discussions.

Research Applied, Replicated or Taken to Market

While none of the research projects have been directly applied, replicated or taken to market to date, the Partnership remains hopeful that new opportunities will emerge with time to replicate some of EIWR's most innovative research projects. Projects with the potential for replication include the innovative prototype latrines built in Hawassa , the Kori de-fluoridation vessel, and some of the findings from the students' theses and dissertations. The Health Extension Worker Training, implemented in 2014, would be an excellent project to replicate. The trainers wrote the training manual with input from field research conducted during the undergraduate summer outreach activity. The trainers used a participatory case study approach which the participants rated highly. Findings from that experience informed the training in each of the five regions where both activities took
place. The participant feedback was very positive and participants requested that the training be provided for everyone in their group.

Objective 4. Improve AAU's and partner institutions' outreach capacity

Project Outcome: Increased access to resources and skills through collaborations

Collaborations and Partnerships: Collaboration is a new paradigm for Ethiopia where institutions, NGO's and academic disciplines typically work in silos. Partnerships are not common, there is little

joint learning, and there is little evidence of the synergism that comes from combining resources and expertise. The UCONN/AAU partnership sought to build meaningful partnerships through community outreach, joint research, and educational activities. One Partnership success has been to demonstrate how collaborations and partnerships can be beneficial and lead to better outcomes.

The Partnership encouraged collaborative partnership by 1) implementing innovative research and outreach projects with partner universities and local communities; 2) participating in technical working groups to stay at the forefront of advances in the WASH sector and to explore ways to share resources, support students, search for grant funding and to identify research questions; and staying informed about technology water technology and implementation challenges in the WASH sector 3) building community engagement training in to outreach projects; and 4) inviting representatives of NGO's, private industry, government, and other educational institutions to engage with students, attend workshops and research presentations, provide seminars, and advise students.

The summer undergraduate outreach experience was one example of a collaborative effort leading to strong outcomes. The activity was organized and implemented in collaboration with partner universities, local communities, local health extension workers and local health care officials. The benefits of working together included stronger connections and knowledge about local communities, a better implementation design, and joint learning opportunities. For example local health officials learned more about how to engage communities and how to do WASH assessments from working with the students and representatives from the local universities and everyone learned from each other when student representatives from each of the five regions in Ethiopia gave final presentations.

Engagement leads to stronger relationship between partner universities and local community: EIWR utilized its relationships with local administration and school officials, Hawassa University, parents, and students in Hawassa to design and build an innovative latrine for schools. The outcome is a partnership between the local university and the local community with commitments to further development of sanitation facilities.

Working with local partners requires identifying a common set of priorities and agreeing to a common agenda – and then to formalize this process so that different players have a sense of ownership. Shared agendas can help to focus activities; encourage commitment; and promote lasting partnerships.

Stakeholder Engagement and Strategic Alliances: Examples of some of the strongest technical working group/NGO collaborations are listed below: (See full list of collaborations Appendix iii)

1) Overseas Development Institute (ODI):

EIWR served as a national hub for activities focused on Building Adaptive Water Resources Management in Ethiopia. The Institute hosted and co-organized a stakeholder workshop, prepared and delivered training courses, conducted research for a case study, and helped to draft a road map for future actions. EIWR trained 22 directors from the Ministry of Water

Industry and Environment (MoWIE), and conducted stakeholder interviews, and produced a case study on adaptive water resources management. See a new report on Ethiopian Water Sector "Building Adaptive Water Resources Management in Ethiopia" produced in consultation with EIWR.
http://www.odi.org/publications/9568-building-adaptive-water-resources-management-ethio pia

2) International Water Management Association (IWMI):

IWMI provided full access to EIWR students to its compound with high speed WiFi network at the heart of the city, its exceptionally equipped resource centers/ libraries, reading rooms etc. advised PhD and MSc students, provided various seminars to EIWR students and staff as well as engaged in various professional workshops. The collaboration has led to the establishment of the National Multi-stakeholder Water and Land Platform; which is chaired by WaterAid while EIWR chaired the policy support wing.

3) Millennium Water Alliance (MWA)

MWA guidance and research support to EIWR students focused on the WASH sector. MWA provided consistent collaboration during the three undergraduate summer outreach programs and provided support for project development. EIWR has been a permanent and reliable partner/adviser and it has been consistently engaged during quarterly meetings and strategic planning workshops. MWA facilitated our research, advisory and partnership network with its 16 non-profit members. EIWR serves as a permanent member of the national Water Sector Panel of Experts.

4) UNICEF

UNICEF provided financial support to the Kori Water Supply project (through Afar BoWR); and the construction of water supply structures. They provided guidance and research support to some EIWR students on the WASH sector. EIWR staff participated in various local and international urban WASH workshops.

5) Italian Cooperation

The Italian Cooperation engaged 25 undergraduate students in identifying problems and designing rural WASH projects (improved communal latrines and water supply schemes in Arsi zone), and co-financed the student engagement along with EIWR.

Proposals Developed:: the Partnership has submitted at least eight proposals for additional funding over the last year. EIWR staff won a grant for students to explore de-fluoridation at the household

level. Some grants have not been successful and others are still pending. UConn and EIWR have a large center grant proposal

Project Outcome: Awareness and adoption of sustainable solutions to water and sanitation challenges including developing water and health problem-solving capacity of extension agents and community.

EIWR worked with 24 different communities on water and sanitation challenges through four community outreach activities. 16,095 people benefited directly from EIWR's activities which involved building innovative latrines, teaching the critical moments of handwashing, providing an experiential learning experience for undergraduates, and guiding a community on how to install a community level de-fluoridation vessel.

Summer Experiential Learning Programs: The Partnership ran four undergraduate outreach activities and one high school camp working closely with the five partner universities over the last four years. In FY14, the Partnership implemented two different experiential learning models; 1) a community experience in public health outreach work, data gathering, problem identification, stakeholder presentations, and 2) a smaller program in Mekele where a group of 18 undergraduate students participated in a more intensive field work experience in water and agriculture with more emphasis on learning research skills.

Summer Outreach Students in Sheno 2014

Students benefited from the program in the following ways:

- Learned about the water challenges faced by local communities.
- Gained exposure to fieldwork, community engagement, (pipeline for future researchers), presentation skills, data analysis skills and exposure to water problems
- Learned to work on multidisciplinary teams
- Became aware of graduate degree options in WASH and WREM fields
- Learned to conduct surveys and focus groups
- Learned how to present public health information (demonstrations of hand washing) to families

Handwashing Poster

Outside experts provided additional training for the students adding depth to their learning. At the first undergraduate camp, the National Meteorological Agency gave a hands-on demonstration on

how weather stations work and collect data and the Oromia Water Works gave a hands-on demonstration on how they undertake water resource assessment studies. Students also used a microscope for their very first time during their visit to an AAU Lab.

The students from the FY14 summer program reported that they valued their experience because it put them in the company of engaged, proactive, and passionate peers from different disciplines. They learned to work in teams and improved their research and community outreach skills. Some reported that the experience gave them the opportunity to learn more about the realities faced by people living in rural areas and peaked their interest in continuing graduate work in public health. They also gained the ability to synthesize their academic coursework with real world experience, learned the importance of developing context sensitive solutions that best serve the need of the local communities, and were pleased that they had an opportunity to give back to the community. The students' engagement initiated community interest on WaSH and communities started to demand their rights from government (e.g. AAU students engagement in Sheno town).
Student engagement also stirred woreda government representatives to commit to respond to community demands and find solutions to communities problems.

Innovative School Latrines in Hawassa - with a Shower Option for Girls: With the assistance of local community members, EIWR designed and installed an innovative school latrine and water supply systems in model primary schools in Southern Nations and Nationalities Regional State (SNPPR) specifically enhanced to meet the needs of girls. With guidance from participants from Hawassa University, EIWR selected Bushulo and Chef Koti Jebesa rural primary schools in the vicinity of Hawassa University. After identifying insufficient latrine and water supply systems mainly for girls including broken connections and damaged drinking water fountains and hand washing basins in each primary school, EIWR started constructing girls latrines and water fountains in March 2014.

The handover of the two school latrines and two water points took place on 14 July, 2014. The new girls' latrine includes 4 seats and one sanitary room installed for girls in each school (with one seat designed and reserved primarily for disabled female students and staff) and hand washing units as well as a drinking water fountain that serves the school community.

At the handover, the contractor signed a sustainability agreement along with EIWR, Hawassa University representatives, and the School Director. Following the handover ceremonies, EIWR, Hawassa City Administration Education and Health Offices, School Principals, Parent Teacher Associations (PTA) members discussed various common concerns and priorities. This initial multilateral meeting has inspired the key players to further work on sustainably managing and promoting as well as facilitating meaningful concerted engagements focused on long term WaSH strategies. [For Success Story on Hawassa see Appendix A]

Innovative Latrine for Girls in Hawassa

Health Extension Worker Training (HEWT): The Ethiopian Institute of Water Resources (EIWR) held a three-day training workshop for health extension workers from four regions on how to engage and train communities around potable water, sanitation and hygiene practices. EIWR held the workshops in November and December 2014 in Arbaminch (Nov 30 - Dec 2,2014), Bahir Dar (Nov 28 - 30,2014), Hawassa (Nov 28 -30,2014), Mekelle (Dec 13 - 15, 2014)and Sheno (Dec 16 - 18,2014), in the same communities where EIWR held its annual summer community engagement program for undergraduate students the previous summer. EIWR staff, representatives from partner universities including Addis Ababa University, Arba Minch University, Bahir Dar University, Hawassa University, Mekelle University, and regional health bureaus worked together to organize the workshops, to recruit 100 health extension agents (3 male and 97 female) from the five sites, and to develop the training manuals with information specific issues and concerns for each of the four target regions (Tigray, Amhara, Oromia and SNNPR).

The Health Extension Worker training focused on water supply, sanitation, hygiene promotion, and empowering communities to bring about change. The instructors adapted each workshop to address the unique problems facing each region making the training particularly relevant for the health extension workers in each woreda. Participants reported that the training was valuable because it helped to fill critical gaps in knowledge, emphasized the importance of understanding problems from the community's perspective, and explained the critical relationship between water supply and health. They also said that the training helped them to better understand their responsibilities and how important it was to work with other stakeholders.

Water Defluoridation in Kori-Afar: In an effort to address a significant water problem faced by many people in Ethiopia, EIWR designed a community scale water defluoridation unit which has the capacity to provide 5 liters of water a day to 4,000 people. In Kori, Afra, well water can have harmful levels of fluoride. The community has everything they need to operationalize the system from the vessel and

activated alumina to a testing protocol and operations manual. Unfortunately, efforts to find a contractor willing to construct the platform for the vessel have failed because of the remote location and harsh conditions.

De-fluoridation Vessels in Kori, Afar

The staff at EIWR has been working closely with a number of stakeholders in the area near Kori, Afar to attempt to move the project forward. Staff met with 28 participants from Kori and Semera including representatives from the regional water bureau, wereda administration, Woreda water bureau, kebele administration, and local community.

Project Outcome: Public sector decision makers provided with research-driven policy guidance.

EIWR and UCONN wrote five policy briefs for distribution to decision-makers. (See box below). These briefs are available on the website at www.eiwr.org. EIWR also provided training manuals to health extension workers on water and hygiene principles.

Working Papers and Policy Briefs

- Reflection on Sediment Retention and Valuation Process
- Physio-Chemical Water Quality Analysis of Water Supply Reservoirs of Addis Ababa City
- Defluoridation of Ethiopian Groundwater using Magnesium Oxide
- School WASH Project in Selected Primary Schools of Ethiopia
- Need Based Health Extension Workers Training on Water, Sanitation and Hygiene: Evidence from Community Outreach Program

Section 3: Shared Learning

Challenges

The Partnership's mission was to build higher education capacity in the area of water resources in Ethiopia, while creating opportunities for innovative need based research and community outreach programs and while building the Institute's capacity to effectively and efficiently grow in all three areas. The Partnership had many successes in each of these areas but not without challenges.

Growing EIWR as an Institute: Building an institute from the ground up is challenging administratively, financially, and logistically. Establishing institutional procedures to ensure that graduate programs and other Institute activities comply with the rules, regulations, and expectations of its home university Addis Ababa University (AAU)) continues to demand attention as the Institute strives to become self-reliant, transparent, and sustainable. EIWR is still working to define its role and structural relationship with AAU while at the same time building collaborative relationships with multiple institutions. For example, to grow the education program, EIWR had to develop mechanisms for sharing teachers with university departments. Being anchored within another Institution means adherence to policies and procedures that sometimes challenge a small staff. The procurement challenges required by this project were particularly challenging and could have benefited from the support of AAU staff with expertise in procurement. Early on in the project, there were delays when EIWR struggled to make sure that the curriculum development process was authorized by AAU and met university standards and that other departments were on board.

Leadership Changes: Since the beginning of the project, several changes in Institute and Partnership leadership resulted in the disruption of critical activities and delays. Each new leader brought a different set of skills and new opportunities, however it was often difficult to make up for lost time.

Akaki Campus was Remote: Having the EIWR located at the Akaki campus was a challenge for everyone. Many staff had to travel two hours each way to work which meant fewer working hours at the office. The location also made recruiting teachers for courses and staff a challenge. The Akaki campus did have advantages in that it was a nice location for the students and a pleasant place to work.

Cost Reimbursement Model: EIWR, like UCONN, was required to work on a cost reimbursement basis which meant that expenses could only be reimbursed through the grant after they had occurred. Initially, this created a problem for EIWR because, initially, the Institute did not have sufficient working capital to cover expenses while awaiting reimbursement. UConn eventually provided EIWR with a cash advance financed with matching funds, but prior to this the project faced significant delays.

Unrealistic Expectations for PhD Students: The Partnership originally planned for the WASH PhD students to graduate in three years. This turned out to be an unrealistic expectation given that the program was new, teachers where coming from abroad, and laboratory equipment purchases suffered delays. If the institutional structure for the program had been fully in place, then it might have been possible. Developing and approving the curriculum took more time than expected and

scheduling faculty to travel and teach for three weeks was often difficult because of prior commitments. Research costs were higher than anyone anticipated causing delays while students sought additional funds to finance data collection and laboratory analysis.. While students received research support funds, many PhD students struggled to find sufficient funding to complete their research. Every effort was made to help students find additional funding through scholarships or other means.

Outreach Challenges: When the implementation plan required EIWR to construct facilities when developing and implementing innovative technologies, the Institute sometimes struggled. While EIWR did successfully manage the construction of latrines and water points at two elementary schools in Hawassa, the Institute was not able to successfully install a de-fluoridation system in Kori Afar. In part this was because Kori's remote location, poor roads, and the distance to the implementation site, created tremendous challenges, but also because the staff managing the project did not have the project management skills and resources required for a project of this complexity. In retrospect, it might have been better to partner with an NGO with experience implementing construction projects in challenging areas.. As it was, the learning curve was steep for EIWR and drew considerable resources away from other activities. It might have worked better to test the defluoridation technology at a more accessible site, allowing the Institute to focus more on piloting and perfecting the technology before implementing at a remote site. This approach may have been more in line with the role of an academic research institute and have accomplished more in the long run.

Lessons Learned and Best Practices

- **Establishing an Institute Takes Time and Patience:** Setting up all that is required to establish a strong, financially sustainable research institute can take a long time. Relationships need to be built, a track record for research and policy development established, institutional structures developed, and capabilities and successes communicated to a broader audience. EIWR has come a long way since this Partnership began, but still needs time to grow.

- **Need to Improve/Strengthen Outreach Model and Model for Innovative Research Activities**
  – Some of the project's greatest successes resulted from the community outreach activities but these outreach projects also pulled resources from other priorities, in part because the staff lacked experience in some areas. EIWR staff were not experts in construction and contracting and it's not necessarily clear that they should have been. For future projects, staff skills need to align with implementation requirements (engineering skills, research skills, contracting and construction, etc.) Perhaps it would have been better to set up a contract with a firm or NGO skilled at implementation in challenging areas. Another problem was that project implementation schedules and deadlines do not always correspond well with the time needed for innovative research.

- **Attention to Advisor Model Critical** - The model for advising was a good one when it worked but the students required additional support. Because students were not in a traditional

department based setting, the research coordinators played a vital role in providing consistent support and moving students forward during the research design and implementation phase of their work.

- **Student Connections with NGO's and Industry:** One of the program's goals was to promote collaboration with NGOs and other stakeholders through the students' research projects which would significantly increase the impact of the research in addressing national needs. We tried to engage stakeholders to serve as research advisors to the students and invited them to numerous EIWR events. These types of collaboration, however, require time to develop and require monitoring and attention to ensure success. EIWR staff did not have experience in this area and would have benefited from more support in building student/industry partnerships.

- **Seminars and Short-term Trainings Extremely Beneficial to Students**- Students reported that they highly valued the seminars and saw them as important learning opportunities. Students benefited from the relationships that EIWR developed with faculty from a large number of international universities who came to EIWR to present seminars. Students particularly enjoyed the open discourse - something not always found in their traditional classroom settings.

- **Financial Support is Needed to Recruit Female Students:** Female students applied in significantly greater numbers to the program when financial support was available. When financial support is not available for domestic higher education programs, top female students seek other international higher education opportunities.

- **Relationships with Partner Universities Need to Grow:** Communities can drive research if the proper relationships are in place - but these relationships have to develop over time. New ways of working with the partner universities need to be explored.

- **Stronger Advising is Needed when Students are Choosing Research Topics**: In a resource challenged environment, it is critical to help graduate students focus on research topics in ways that lead to the most efficient use of resources and the strongest research results. There is a need for joint research projects which allow several students to work on related topics, with newly collected primary data, and topics of critical relevance to water problems in Ethiopia.

- **Bringing International Faculty to Students**: Bringing international faculty to teach in Ethiopia exposed students to a variety of teaching methods, courses, and critical thinking . Relationships between students and international faculty led to new teaching approaches, opportunities for internships, joint scholarship, and an expectation of standards. By bringing the faculty to Ethiopia, more students had the opportunity to benefit from the program than if the program had sent students abroad.

- **Collaborative Research:** For the WREM students, we successfully guided students toward research topics in ways that created research synergies and optimized use of the available laboratory equipment, faculty expertise, and funding available for research.

- **Undergraduate Experiences:** The undergraduate experiential learning summer outreach experience helped build relationships with local communities; encouraged multi-disciplinary learning; provided training in outreach and research to students; and encouraged students to go into health fields. Students reported that this was a life changing experience because it helped them to better understand the WASH challenges in their country.

Section 4: Sustainability

Sustainability

In general, establishment of a university based research institute requires time, resources and strong commitment by all the partners. The strong support and commitment from USAID, HED, AAU, UConn and other partners has greatly accelerated the establishment of EIWR as a unique research institute in Ethiopia focused on water related development challenges. Going forward, it will be critical that AAU and UConn continue to support EIWR and that external support is secured to sustain and grow its activities.

Since its establishment in 2012, EIWR has become a fully integrated institute within Addis Ababa University. It was established as an independent cost center with a budget of 3.4m Birr (about $170,000) for the 2015/16 fiscal year. Demonstrating its commitment to the mission of the Institute, AAU has provided support to EIWR to hire staff and provide facilities for housing students, teaching courses, and program administration. EIWR will enroll new students this fall into the WASH and WREM programs, which are now part of AAU's standard offerings. One of the EIWR's greatest challenges will be to hire faculty to deliver courses and staff to administer the academic programs.

AAU is close to completing a long-term strategic plan for the entire university. When this is complete, EIWR will develop their own strategic plan which will consider the goals and priorities outlined in the University plan. This plan will help EIWR to develop a strategy for seeking additional funding for program development, innovative research, graduate student fellowships and internships, and research lab development. The institute will need to search for funding from a variety of sources including AAU, ministries and other federal sources, corporations and foundations, as well as through collaborations with UCONN and other foreign universities. EIWR will also develop a human resources plan as part of its strategic plan.

AAU has designated funds out of its capital budget for the design and construction of new buildings and laboratory facilities for EIWR on the outskirts of Addis. The design will be completed within half a year and construction is expected to start in early 2016.

Sustaining the Long Term Impact of the Program

The UConn/AAU Partnership will continue to build on the strengths of the existing program. The partnership has submitted several grant proposals which, if funded, would allow UCONN and EIWR to implement new and continue ongoing joint research projects on a range of water resource topics. UCONN and EIWR will continue to work together to find ways to meet the goals of the Institute's long-term strategic plan which include building programs in water and agriculture and water and governance - areas critical for promoting sustainable economic development. A number of joint

research projects will continue as students continue publishing with their UCONN advisors and as research on clay filters and other topics continue.

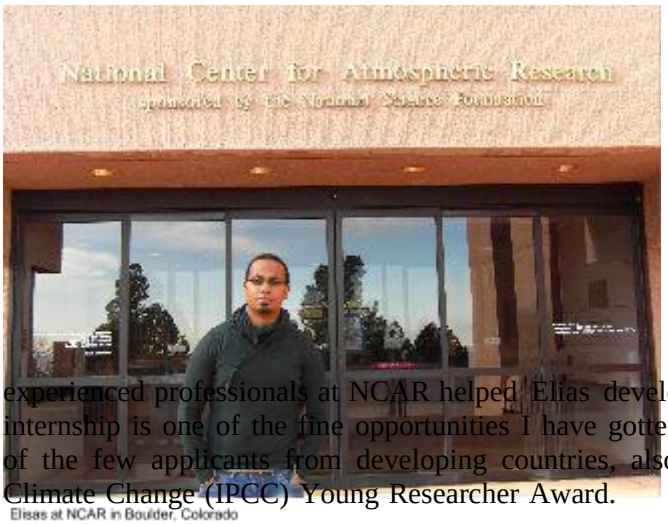
Even if no additional work was accomplished by the Partnership, the program will have a long term impact through its graduates. Program graduates have moved on to teach new generations of students and others will exert influence through their jobs in water resources areas. This impact would be greater if ways can be found to mentor the graduating PhD students, helping them to reach the next level of research, proposal writing, networking, professional development within the Ethiopian higher education system.

As EIWR moves forward, there is a need to increase visibility as a center that can form research agendas and influence policy. Continuing to do high impact research, write policy papers, and maintain communications (website, newsletter, etc) will all be important component of this strategy.

Appendix A: Success Stories

International Internships Advance Research and Benefit EIWR Students

International internships are helping EIWR make significant contributions to climate change scholarship by providing training to highly qualified Ph.D. candidates. Elias Tedia, who was among the Institute's first Ph.D. students, spent the last three months working at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. While at NCAR, Elias has been conducting research on "Multi-Reservoir Operation Optimization under Different Climatic Scenarios to Maximize Energy Production Efficiency." Funded partly funded by the Early Career Scientists Assembly Visitors Fund, this research investigates the relationship between climate change, water resources, and energy production. Elias credits his stay in Boulder with significantly advancing his dissertation research. The experienced professionals at NCAR helped Elias develop valuable skills and knowledge. "I feel this internship is one of the fine opportunities I have gotten in my academic life," says Elias, who, as one of the few applicants from developing countries, also won the 2013 Intergovernmental Panel for Climate Change (IPCC) Young Researcher Award.



Elisas at NCAR in Boulder, Colorado

Belete Berhanu Kidanewold, a EIWR Ph.D. student interested in hydrological modeling related to the interactions of catchment attributes on rainfall runoff, has been an intern at Florida International University since July. Already an accomplished researcher, Belete published a paper, "GIS-based Hydrological Zones and Geo-soil Database of Ethiopia," in the May 2013 issue CATENA, an internationally respected journal of Soil Science, Hydrology, and Geomorphology. A second publication, "Surface and Groundwater Resources of Ethiopia: Potentials and Challenges of Water Resources Development," is appearing as a book chapter in Nile River Basin-Ecohydrological Challenges, Climate Change and Hydropolitics, from Springer.

From the Florida internship, Belete is gaining valuable time to concentrate on his research. When in residence at EIWR, his time is divided between various social and economics-related activities in addition to his research responsibilities, whereas the internship program provides a full time research environment. Belete credits the internship with broadening his knowledge through discussions and interactions with other Ph.D. students, postdoctoral researchers, and professors. Florida International University also provides easy access to resources, such as books, journal articles, and software, that are essential for conducting research. The internship has allowed Belete to conduct most of the data analysis part of his dissertation research, and to take online training courses on writing scientific papers. Belete's mentor at Florida played a valuable role in his success. Says Belete, "My face-to-face discussions with my mentor, Dr. Shimeles Desu, were unforgettable."

These internship opportunities were facilitated by local and international faculty advisors who have assisted students with networking internationally in order to find opportunities for research.

NewLatrinesPromoteHygieneandSanitationatTwoEthiopian Schools

Wash your face and hands with soap,
Where soap is not available
Hands can be washed with ash and water
Wash them every day
*Will help keep germs away**

*Poem written in commemoration of the new school latrines at Busulo Primary School, by first name, age 9

In much of Ethiopia, a well-built, functioning latrine is a dream come true.

Most schools in Ethiopia do not have any water supply or toilet facilities at all, and school children often resort to open defecation. Schools that do have toilets may lack hand washing facilities. Many school sanitary facilities are filthy and unusable, forcing children, and particularly girls, to miss school.

To help remedy this situation, the Ethiopian Institute of Water Resources (EIWR) in collaboration with Hawassa University and with the financial support of USAID constructed latrines and water fountains at two primary schools near the city of Hawassa, Ethiopia.

The latrines are modeled after the national standard design and construction manual endorsed by the Ministry of Health, Education and Water, Irrigation and Energy in collaboration with UNICEF.

Old girls latrine at Busulo Primary School

During the project planning phase, EIWR responded to community concerns and adapted the latrine design to include a special sanitary/ menstrual room. Based on sound engineering principles, the final desig accommodates all local, state, and federal codes to meet contextual, societal, and cultural conditions.

The new girls latrine design features 4 seated latrines, 4 seated urinary seats, and one sanitary room, and includes accommodations for disabled students. [Boy's latrine?] [bdj2] Hand washing units and a drinking water fountain serve the entire school.

On July 14, 2014, the opening of the latrines was marked by a special ceremony attended by an enthusiastic crowd of parents, children, and administrators. Children performed original songs and recited poems to commemorate the opening of long-awaited latrines.

Teaching children about hygiene and sanitation has wide-ranging impact. In addressing the crowd at the latrine opening ceremony, Ato Adem Shafi, Director of *Chefe Koti Jebesa* Primary School, stressed that "School children are agents of change to the communities, particularly in

the use and management of water supply and sanitation facilities. By providing school children with the tools and knowledge to change behaviors at school, we encourage them to share information and knowledge with their parents, family members and the community to achieve better health, environmental, sanitation and hygiene practices."

Based on the enthusiasm on display at the opening ceremony, the school's sanitary improvements are already having a positive impact on the community. One mother at *Busulo* primary school summed up the community responds by saying, "Thank-you USAID. We are very grateful for the toilets."

Guests at the opening ceremony try out the new water suppply foundation at Chefe Koti Jebesa (left) and Busulo (right) Primary Schools

AHealthCareProviderWorkstoPromotebetterSanitationPractices

Eftu Abi is one of 38,000 rural health extension workers in Ethiopia. She practices at a health post in Sheno Woreda, Indode Washa Kebele in the northeastern part of the country where she spends time time visiting families in their homes. She has wide ranging responsibilities for community-based health promotion and curative care in Indode Washa Kebele. Her workload is diverse, and over the course of a week she divides her time between activities relating to family health, disease prevention and control, hygiene and sanitation, and other activities.

Health Extension Workers Receive Training in Sheno

In November and December 2014, the Ethiopian Institute of Water Resources (EIWR) of Addis Ababa University organized a three-day training workshops for 100 health extension workers from four regions on how to engage and train communities on potable water, sanitation and hygiene practices. The workshops were held in Arbaminch, Bahir Dar, Hawassa, Mekelle and Sheno.

Eftu was one of the participants of this training at the Sheno site. Eftu said that the training enhanced her knowledge and workplace performance. She valued the participatory approach of the training with the chance to share her own experiences with other health extension workers. She added that the training helped her to learn how water is contaminated from source to the household level, how to select proper sites for WASH facilities, the connection between sanitation and water, to name a few.

"The training is the most useful and productive experience. I am now confident in successfully applying/implementing my new skills in my daily work at the community" she says.

Her plan for the future is to continue applying the concepts presented at the training to increase community awareness in health through the involvement of communities and provision of continued health education and promotion to bring about positive changes in the knowledge, attitude and behaviour of the community.

THE DREAMERS

SHENO TEAM NOW AND THEN…

Contributed by the Sheno Team

The Sheno team is a group of twenty graduating students from Addis Ababa University & Addis Ababa Institute of Technology among which fourteen are Civil & Environmental Engineering Students and the rest Six are geology students. These students came from different backgrounds and most of them didn't know each other it was the first time they met. They were all part of this team because they got elected for the 2014 summer community outreach program by Ethiopian Institute of Water Resources.

The task of this group was to identify the problems of the community related with water supply, sanitation and hygiene. The study group was a small town community located about 80kms from, Addis Ababa, the capital city of Ethiopia. This small rural town was the town of Sheno. So these were the events that led to the foundation of the **SHENO TEAM** at the present time called "**THE DREAMERS**".

In addition to gathering data and reporting what the current conditions are the team has taken additional steps to help the community. This was a result of the deep bond they have made with the people of Sheno during their stay. The data gathered indicated that the people of the town are facing real problems in the areas of WASH. To address the issue of personal hygiene the team decided to teach more people than expected.

After finishing filling the questionnaires the next task was to give additional awareness on the importance of personal hygiene and how to keep it. Their task involved getting to a certain number of houses and teaching them on the issues. But the team has gone to houses more than expected and they have used public places like hotels, clinics and markets to post published papers showing steps on how to wash their hands the right way. The team has also managed to take a stage with the permission they got from the mayor of Sheno and gave awareness to the people during a community meeting which is held once a year to talk with the governing officials on the plans for the coming year.

After the summer of 2014, there were some members of this team which still had a lingering feeling of disappointment. The disappointment was caused by the fact that no matter how much effort they have put it was just not enough to bring change on their own to the community they have worked for so closely and they have seen suffers. So these three students (Maroof, Nebiyou and Nigguse) among the twelve friends in the Sheno team have decided to

try again, and to try harder this time. They spent most of their small leisure time trying to find donors. But what they figured was that almost all donors need a proposal well formatted and prepared according to their specifications. After observing what kind of proposal these donors need they realized the proposal they prepared for the Sheno community wasn't good enough to get funding. So they decided to learn and gain additional knowledge on how to write a proposal and update the last proposal for funding. When they were in the middle of this the Project Manager for AAU-UCONN, Joy Larson come to visit them. Her visit has inspired these three students to do more. She also encouraged them to work harder and to stay positive. Well that is what they have been doing after that. They have founded/created a volunteer group on Facebook which has over 2000 members currently with in a very short time (less than two month). It is called **Let's Help Each Other** or in short **LHEO**. The main aim of this group was to create a medium where people find a person that can willingly give them a hand. It is a group that preaches doing good and doing voluntary things. The relation of this group to the Sheno community is that after the group develops and builds its trust, this group might be the source of fund and skilled professionals. This is because these three students believe that whatever it takes they will make a difference in Sheno town and other towns in the future. They have also figured out that funds are granted to an authorized official institution or association. So before asking the funds they decided they need to develop an association. So at the moment they are updating the proposal to meet donor's requirements, preaching goodness and gathering volunteers and also in the process of making a legal association. They believe they owe Sheno a lot. Sheno have given them long lasting friends, unforgettable memories, sense of responsibility and commitment, an opportunity to think like professionals while they are still students, an opportunity for personal development and many more. This is why they have decided that they will not rest, today or ever, until the people of Sheno get the adequate amount of water supply and sanitation facilities.

Appendix B: List of Short-Term Trainings and Seminars

Short-term Trainings and Seminars from 2012-2015					
			Number of participants		
Training Title	**Seminar Speaker**	**Date**	**Male**	**Female**	**Total**
Hydro geophysical Investigation	Prof. Linbo Liu University of Connecticut Dr. Tigistu Haile AAU	10-Dec-12	14	2	16
Internships/exchanges at USA Universities	Elias Tedla Shiferaw- National Center for Atmospheric Research, CO Belete Berhanu Kidanewold- Florida International University	2013	2	0	2
Water Security in Ethiopia Highlands: How to learn management help as the climate changes	Kevin Bishop Swedish University of Agriculture	30-Oct-13	28	26	54
The local and global dynamical features(DRIVERS) that control the climate and hydrological extremes over Ethiopia	Prof. Mary Jury University of Puerto Rico	8-Dec-13	6	1	7
Qualitative data study designing, text data collection, text data analysis, and use of open code	Dr. Mitike Molla AAU	12-Dec-13	18	15	33

How to read, review, and critically appraise a published article	Dr. Fikre Enqusilasie AAU	13-Dec-13	11	12	23
Water Quality Management	Dr. Ing Havbil Eckstadt University of Rostock	18-Dec-13	24	15	39
Tool Designing	Dr. Fikre Enquisilasie AAU	24-Dec-13	9	17	26
Research Ethics	Dr. Adamu Addisse AAU	26-Dec-13	10	8	18
Data Template Managment using epi info Version 3.5.3	Dr. Abera Kumie AAU	1-Jan-14	11	12	23
Adapting to flood risk under climate change	Prof. Rob Wilby Loughborough University	27-Mar-14	15	5	20
Water, food and livelihood security in Northern Ethiopia and Maximization of Sesame & Cotton Productivity in Humera and Tsegede Areas in Ethiopia	Mekonnen Gebremichael University of Connecticut	July-August 2014	14	4	18
Baseline Data Collection Training at Hawassa University		26-May-14	8	2	10
Conversion of Wastewater to Electricity in Microbial Fuel Cells	Dr Baikun Li University of Connecticut	4-Jun-14	16	8	24
Methods for Landslide Prediction	Dr Amvrossios C. Bagtzoglou University of Connecticut	12-Jun-14	12	4	16
Climate Change & Human Health	Dr Janvier Gasana Florida	August 22,2014	8	4	12

	International University				
Summer Undergraduate Community Outreach	Various Instructors	Mid May-June 2014	64	32	96
Training on Building Adaptive water resource management in Ethiopia	Dr. Azage G/yohannes,	September 21-25, 2014	20	2	22
	Mr. Tesfay Alemseged, Mrs. Tigist G-Medhin				
Human Resource Management	Mr. Worku Gizaw,	October 19-21, 2014	1	2	3
	Mrs Asnakech Teferi	November 23-24, 2014			
	Mrs Medina Ali				
Nutrient Cycling and Lab Techniques	Dr Erik Karltun, Swedish University of Agricultural Sciences	24-Nov-14	10	1	11
Advanced Wastewater Treatment	Prof. Hartmut Eskstadt, University of Rostock	10-Dec-14	5	2	7
Introducing SPSS as data analysis tool	Dr. Girmay Medhin, AAU School of Pathobiology	16-Dec-14	6	2	8
Data Overload: How to deal with Multi Dimensional Data Sets	Dr. Dereje Teferi, Addis Ababa University	23-Dec-14	9	1	10
Introducing STATA as data analysis tool	Dr. Girmay Medhin, AAU School of Pathobiology	30-Dec-14	6	2	8
Concepts, Techniques and Models of Computer Programming	Dr. Dereje Teferi, Addis Ababa University	January 6,2015	9	0	9
Water Resource Management and Global Politics	Mr Mattia Grandi, PhD candidate at the Scuola Superiore	12-Jan-15	9	0	9

	Sant'Anna (Pisa, Italy)				
Introducing analysis of repeated continuous and binary outcome data	Dr. Girmay Medhin, AAU School of Pathobiology	14-Jan-15	6	2	8
C++ Object Oriented Concepts	Dr. Dereje Teferi, Addis Ababa University	20-Jan-15	9	1	10
The use of remote sensing to support hydrologic applications and water management with a selection of case studies	Professors Juan B. Valdés and Aleix Serrat-Capdevila, University of Arizona	23-Feb-15	18	2	20
Eddy Covariance Gas Analyzer Measuring Instrument	Dr. Eltayeb Sulieman Nile Babikir, Univ of Khartoum	March 9-16, 2015	8	2	10
Hydroclimate modeling: a tool vital for meeting water resources challenges	Dr. Clement Alo, Montclair State University	10-Mar-15	19	1	20
Systems Approaches to Study Climate, Water and Diarrhea	Prof. Jonathan Mellor, University of Connecticut	16-Mar-15	9	4	13
Training of 4 EIWR Students	Habiba Gashaw, Getachew Redaie, Hailemariam Feleke, Meseret Desalgn	February-March, 2015	2	2	4
Interventions to Control Contamination of Surface Water Resources	Dr Solomon H/mariam Addis Ababa University	14-Apr-15	11	2	13
Routes and Mechanisms of Transmission of Waterborne Bacterial Infections	Dr Solomon H/mariam Addis Ababa University	21-Apr-15	11	2	13
Water related Viral infections and Diseases	Dr Solomon H/mariam Addis Ababa University	27-Apr-15	10	2	12

Impact of Water Resource Development on Schistosomiasis	Prof. Berhanu Erko Addis Ababa University	6-May-15	10	2	12
Role of WASH in the Prevention and Control of Soil Transmitted Helminthiasis and Schistosomiasis	Prof. Berhanu Erko Addis Ababa University	12-May-15	11	2	13
Potential Threat of Submicroscopic Plasmodium Falciparum Infection to Malaria Control	Prof. Berhanu Erko Addis Ababa University	21-May-15	10	2	12
			479	**205**	**684**

Appendix C: Student Research Topics

No.	Name	Gender	Home University	Region	Program Enrolled	Degree	Thesis Title
1	Mahtsente Tibebe Tadese	F	Ethiopian Institute of Agricultural Research	Federal	Water Resources Engineering & Management	MSc	Estimation of Runoff variability due to Rainfall and Land cover change at Omo Gibe River Basin
2	Muna Shafi Yesuf	F	Addis Ababa Health Bureau	Addis Ababa	Water and Public Health	MSc	Effects Of Water Sanitation And Hygiene Implementation On Childhood Diarrhea Among Communities Of Meskan District, Southern Ethiopia
3	Tsega Menhasebo G/Hiwot	F	Haramaya University	Oromia	Water and Public Health	MSc	Assessment of In-School Children's Hygiene Behaviour and Schools' Sanitation: Lideta Sub City, Addis Ababa
4	Betelhem Belayneh Demissie	F	Ethiopia Health and Research Institute	Addis Ababa	Water and Public Health	MSc	Assessment of Fecal Bacterial Load and Associated Factors at Household Drinking Water in Holata Town, Ethiopia
5	Genet Gedamu Kassie	F	Arba Minch University	Debub	Water and Public Health	MSc	Assessment of Prevalence and Factors Associated With Diarrheal

							Diseases among Under Five Children of Farta District, South Gondar Zone, Amhara Region
6	Almaz Atakilti Kidanemariam	F	Arba Minch University	Debub	Water and Wastewater Treatment	MSc	Assessment of Cause and Consequences of Cyanobacterial Blooms in Lake Chamo, Arba Minch, Ethiopia
7	Aselefech Getachew Hailu	F	Harari Environmental Protection Authority	Hareri	Water and Wastewater Treatment	MSc	Assessment of Surface Water Quality of Sibilu Dam Site and its Tributaries
8	Konjit Hailu Mamuye	F	Haramay University	Oromia	Water and Public Health	MSc	Bacteriological Water Quality of Protected Wells and it's Point of Use, and Associated Factors in Haramaya District, Eastern Ethiopia
9	Belaynesh Negesse Enyew	F	Tigray Water Resource and Energy Bureau	Tigray	Water and Wastewater Treatment	MSc	Drinking Water Quality Assessment from the Source to the Point of Consumption in rural Area of Dangla woreda, Amhara Region, Ethiopia
10	Bethelhem Kinfu Gurmassa	F	Haramaya University	Oromia	Water and Public Health	MSc	Assessment of Water Quality and Potential Public Health Risk in Gefersa Tributaries

11	Atalay Getachew Kassie	F	Yejube Health Centre	Amahara	Water and Public Health MSc	MSc	Assessment of Malaria Prevalence and Its Associated Risk Factors In Baso Liben District, East Gojjam Zone, Amhara National Regional State, Ethiopia
12	Asegedech Wondimu Butako	F	Sigmo Health Center	Oromia	Water and Public Health MSc	MSc	Assessment of Level Of Exposure To Fluoride In Drinking Water And Risk of Fluorosis Beyond The Rift Valley Region: The Case Of Jimma Town, Southwest Ethiopia
13	Lili Degife Gissa	F	Addis Ababa Health Bureau	Addis Ababa	Water and Wastewater Treatment	MSc	Adsorption of Chromium from Aqueous Solution Using Coffee Husk
14	Kidist Bogale Yirbemo	F	Environmental Devlopment Action	Addis Ababa	Water and Wastewater Treatment	MSc	Assessment of Water Quality of the Dire Water Supply Reservoir and Tributaries
15	Husen Ahmed Mehammed	M	Haramaya University	Oromia	Water and Wastewater Treatment	MSc	Chromium and Lead Pollution and Potential Bioaccumulation in Urban Wastewater Irrigation Farming System, the Case of Little Akaki River
16	Mebrahitom Haile Zeweli	M	Ministry of Health	Federal	Water and Public Health	MSc	Population Movement As A Risk Factor For Malaria

							Infection In High Altitude Villages Of Tahtay Maychew Woreda, Central Tigray, Ethiopia: A Case Control Study
17	Biniyam Mohammed Adem	M	Haramaya University	Oromia	Water and Wastewater Treatment	MSc	Assessment of Bacteriological Quality Of Drinking Water From Source To Point Of Use And Sanitation And Hygiene Practices Of The Community: The Case Of Dandaka Kebele
18	Awugchew Teshome Ayele	M	Haramaya University	Oromia	Water and Wastewater Treatment	MSc	Post-Treatment Contamination of Piped Water Supply and Its Attribute to Occurrence Self-Reported Gastrointestinal Illnesses in Urban Slums; the Case of Addis Ababa
19	Wegene Deriba Regasa	M	Haramaya University	Oromia	Water and Public Health	MSc	Assessment of Surface Water Pollution for Legedadi Reservoir
20	Tsegaluel Abay G/Hiwot	M	Mekelle University	Tigray	Water and Public Health	MSc	Assessment of Water Quality and Potential Public Health Threat of Wukro River, Northern Ethiopia
21	Elias G/Tsadik	M	Leather Industry	Federal	Water and Wastewater Treatment	MSc	Chromium Removal from Tannery

	Gebregziabher		Development Institute				Effluent by Eucalyptus Bark
22	Henok Belachew Seyoum	M	Arbaminch University	Debub	Water Resources Engineering & Management	MSc	ET over Different Lithology and Soil Horizons: the case of upper Baro River Basin, Ethiopia
23	Ashenafi Dabeso Regassa	M	Adama University	Oromia	Water Resources Engineering & Management	MSc	Assessment of Sediment Retention and Valuation: The Case Of Godino Watershed
24	Mulatu Liyew Berihun	M	Bahir Dar University	Amhara	Water Resources Engineering & Management	MSc	Analysis of Hydrological Process in Dapo Watershed, Upper Blue Nile Basin, Ethiopia
25	Moges Asfaw Merkeb	M	Bahir Dar University	Amhara	Water Resources Engineering & Management	MSc	Rainfall – Runoff Modelling and Catchment Characterization, Case of Mizewa Catchment
26	Mamo Kassegn Sisay	M	National Metrological Agency	Amhara	Water Resources Engineering & Management	MSc	Evapotranspiration Dynamics at Various Ecohydrology under Change, Baro Akobo, Ethiopia
27	Solomon Berhane Gebreyohanes	M	Mekelle University	Tigray	Water Resources Engineering & Management	MSc	Understanding the Dynamics of Hydrological Processes and Rainfall Runoff Modeling: the case of Meja Catchment in the Upper Blue Nile River Ethiopia

28	Shambel Habte Muluneh	M	Arbaminch University	Debub	Water Resources Engineering & Management	MSc	Effect of Topography on Rainy Season Rainfall Variability over the Blue Nile River Basin, Ethiopia
29	Semere Tesfa Mengesha	M	Adama University	Oromia	Water Resources Engineering & Management	MSc	Sediment Yield Assessment in Gilgel Gibe I Dam Catchment using GIS and Remote Sensing
30	Desta Haftu Hayelom	M	Arba Minch University	Debub	Water and Public Health	MSc	Assessment of Intestinal Parasites Prevalence and Determinant Factors among School Children in Arbaminch Town, Southern Ethiopia
31	Mulugeta Genanu Kebede	M	Arbaminch University	Debub	Water Resources Engineering & Management	MSc	Remote Sensing Based Estimation of Evapo -Transpiration Using Selected Algorithms: the case of Wonji Shoa Sugar Cane Estate
32	Gebite Genamo Gemadi	M	Ministry of Water, 33 Irrigation & Energy	Federal	Water and Public Health	MSc	Assessment of Drinking Water Quality and Diarrheal Prevalence with its Associated Factors on under Five Children in Communities of AkakiWoreda, along Downstream of Akaki River, Oromia Region, Ethiopia

33	Guta Wakbulcho Abeshu	M	Arbaminch University	Debub	Water Resources Engineering & Management	MSc	Characterization Ethiopian Mega Hydrogeologic Regimes Using Remote Sensing Datasets and Models
34	Gebrehiwot Niguse Tesfaye	M	Hawassa University	Debub	Water Resources Engineering & Management	MSc	Effect of Topography in Satellite Rainfall Estimation Errors: Observational Evidence across Contrasting Elevation in the Blue Nile Basin
35	Fasil Teshome Worku	M	Arbaminch University	Debub	Water Resources Engineering & Management	MSc	Hydrological Partitioning and Vegetation Response in Selected Moist Zone Catchment of Ethiopia: Analyzing Spatiotemporal Variability
36	Alemayehu Kasaye Tilahun	M	Arbaminch University	Debub	Water Resources Engineering & Management	MSc	Land Use Land Cover Change and its implication on soil erosion and Surface Runoff: A case study of Baro River Basin, South Western Ethiopia
37	Abel Getahun Workneh	M	Hawassa University	Debub	Water Resources Engineering & Management	MSc	Land Use Land Cover Change Impact on Groundwater Recharge: The case of Change in Upper

							Gilo-Alwero sub-basin
38	Mohammed Abdu Mohammedhabib	M	Mekelle University	Tigray	Water Resources Engineering & Management	MSc	Vegetation Condition Prediction Using Remote Sensing GIS for Integrated Drought Monitoring Approach. The Case of Abbay Basin, Ethiopia
39	Nebyu Solomon Demisse	M	Jimma University	Oromia	Water Resources Engineering & Management	MSc	Spatial and Temporal Rainfall Variability and its effect on Streamflow: the case of Birr Watershed
40	Belete Berhanu Kidanewold	M	Addis Ababa Univeristy	Addis Ababa	Water Resources Engineering & Management	PhD	Development of Rainfall-Runoff Method and Watershed Planning Tool Based on the Hydrological Regimes of Ethiopia
41	Elias Tedla Shiferaw	M	Hawassa University	Debub	Water Resources Engineering & Management	PhD	Multi reservoir Operation Optimization under different Climatic Scenarios to Maximize Energy Production Efficiency